

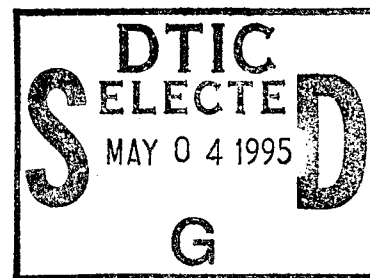
AFIT/GOR/ENS/95M-16

A METHODOLOGY FOR COMPARING
THE VALUE OF
COMPETING AFMC MANPOWER
ALLOCATION STRATEGIES

THESIS

Sandra K. Smith, Captain, USAF

AFIT/GOR/ENS/95M-16



19950503 094

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE March 95	3. REPORT TYPE AND DATES COVERED Master's Thesis		
4. TITLE AND SUBTITLE A METHODOLOGY FOR COMPARING THE VALUE OF COMPETING AFMC MANPOWER ALLOCATION STRATEGIES			5. FUNDING NUMBERS	
6. AUTHOR(S) Sandra K. Smith, Capt, USAF				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Institute of Technology, WPAFB OH 45433-6583			8. PERFORMING ORGANIZATION REPORT NUMBER AFIT/GOR/ENS/95M-16	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This research effort develops a methodology for Air Force Materiel Command (AFMC) decision makers to use during mandated resource allocation exercises for comparing competing manpower allocation strategies. A value model is used to represent the hierarchical objectives of the command, with the primary objective being the attainment of maximum mission effectiveness in the face of constrained resources. Value model decomposition is patterned according to the command's organizational structure. Scoring functions derived using direct assessment survey techniques capture the relationship between manpower and mission effectiveness for lowest level organizations. An additive value function represents the model mathematically; the primary objective value is calculated as a weighted sum of objective values at all model levels beneath it. Results compare overall values obtained with several of AFMC's commonly used allocation strategies to values obtained with existing command manpower resources. Alternatives offering small diminishment (for mandated reductions), or great improvements (for mandated increases), from current value are the best candidates for further evaluation by decision makers. Model sensitivity to weights and to the types of scoring functions used is addressed.				
14. SUBJECT TERMS Value-Focused Thinking; Value Model; Decision Analysis; Manpower			15. NUMBER OF PAGES 85	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

THESIS APPROVAL

STUDENT: Capt Sandra K. Smith

CLASS: GOR-95M

Thesis Title: A METHODOLOGY FOR COMPARING THE VALUE OF
COMPETING MANPOWER ALLOCATION STRATEGIES

Defense Date: Mar 7, 1995

Committee: Name/Title/Department

Signature

Co-Advisor GREGORY S. PARNELL, Col, USAF
Head
Department of Operational Sciences
Graduate School of Engineering

G. S. Parnell

Co-Advisor JAMES T. MOORE, LtCol, USAF
Associate Professor of Operations Research
Department of Operational Sciences
Graduate School of Engineering

James T. Moore

Accession For	
NTIS CRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification _____	
By _____	
Distribution /	
Availability Codes	
Dist	Avail and / or Special
A-1	

The views in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or US Government

AFIT/GOR/ENS/95M-16

A METHODOLOGY FOR COMPARING THE VALUE OF COMPETING
AFMC MANPOWER ALLOCATION STRATEGIES

THESIS

Presented to the Faculty of the Graduate School of Engineering
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Operations Research

Sandra K. Smith, B.A.

Captain, USAF

March 1995

Approved for public release; distribution unlimited

Preface

Changes in the national political environment and military spending alter Air Force budgets and force major command senior leadership to make difficult resource allocation decisions. It is imperative that these decisions be made in a manner that enables commands to perform effectively (optimally) with the resources that remain.

When AFMC is faced with tough manpower allocation decisions, its leaders depend on AFMC/XPM (manpower directorate) resource managers to assess the impacts of various manpower allocation strategies and make insightful recommendations. This research effort is aimed at providing resource managers with a tool to use in comparing the relative values of different resource allocation strategies, thereby developing the insight needed to assist AFMC senior leadership in making good decisions.

This study would not have been possible without the dedication of Col Jacob Kessel and the entire AFMC/XPM organization. I am particularly grateful to Major Nancy Svenson and TSgt Rich Scullion, who, without fail, would drop what they were doing to provide support for this effort.

Special thanks also go to my advisors, Col Gregory Parnell and LtCol James Moore, for their guidance, instruction, encouragement, and patience.

Finally, I give my love and gratitude to my husband Brian, my very own computer support group, for putting up with the late nights, late suppers, and for being all around supportive during my AFIT tour.

Table of Contents

	Page
List of Figures	vi
List of Tables	vii
Abstract	viii
 I. Introduction	 1
Background	1
Problem Statement	3
Research Objective.....	3
Scope.....	3
Overview	4
 II. Literature Review	 5
Introduction	5
Value-Focused Thinking.....	6
Development of Value Models and Value Functions	6
Additive Value Function Assumptions	8
 III. Background.....	 9
AFMC Manpower Structure.....	9
AFMC Manpower Data.....	12
Manpower Allocation Process	13

Model Context	16
IV. Methodology	17
Value Model Development and Description.....	17
TIER I.	17
TIER II.....	17
TIER III.....	18
TIER IV	20
Model Assumptions and Simplifications.....	22
Tier IV Value Quantification	24
Scoring Functions.	24
Value Model Weights.....	28
Mathematical Value Model.....	29
V. Results.....	31
Current Manpower Allocation	32
Allocation Based on Mission Effectiveness	32
Allocation Based on Equal Percentages	34
Allocation Based on Organizational Importance (Model Weights)	38
Model Sensitivity to Input Weights.....	40
VI. Conclusions and Recommendations	42
Conclusions.....	42
Recommendations	43
Appendix A. AFMC Value Model	45

Appendix B. Mission Effectiveness Survey	52
Appendix C. Mission Effectiveness Survey Results	53
Appendix D. Scoring Function Coefficients and Bounds	61
Appendix E. Manpower Levels for Allocation Alternatives	67
Bibliography	73
Vita	75

List of Figures

Figure	Page
1. Upper Tiers of the Value Model	9
2. Sample Scoring Functions	24
3. Resources by Scoring Function Development Category	27
4. Acceptable AFMC Percentage Manpower Changes by MEB	34
5. Value Model Scores for Allocation Alternatives	35
6. Organizations Broken Per Percentage Manpower Reduction	37
7. Peak Effectiveness Gained Per Percentage Manpower Increase.....	38
8. Comparison of Value Model Scores	39
9. Comparison of Scores Using Different Weighting Schemes.....	41

List of Tables

Table	Page
1. AFMC Subcommands	10
2. Relationship Between MEBs and AFMC Center Missions	11
3. Relationship Between HQ AFMC Two-letter Commanders and MEBs	14
4. Resources by Scoring Function Development Category	27
5. Value Model Scores Using Revealed Preference Weights	33
6. Acceptable AFMC Percentage Manpower Changes by MEB	34

Abstract

This research effort develops a methodology for Air Force Materiel Command (AFMC) decision makers to use during mandated resource allocation exercises for comparing competing manpower allocation strategies.

A value model is used to represent the hierarchical objectives of the command, with the primary objective being the attainment of maximum mission effectiveness in the face of constrained resources. Value model decomposition is patterned according to the command's organizational structure. Scoring functions derived using direct assessment survey techniques capture the relationship between manpower and mission effectiveness for lowest level organizations. An additive value function represents the model mathematically; the primary objective value is calculated as a weighted sum of objective values at all model levels beneath it.

Results compare overall values obtained with several of AFMC's commonly used allocation strategies to values obtained with existing command manpower resources. Alternatives offering small diminishment (for mandated reductions), or great improvements (for mandated increases), from current value are the best candidates for further evaluation by decision makers. Model sensitivity to weights and to the types of scoring functions used is addressed.

A METHODOLOGY FOR COMPARING THE VALUE OF COMPETING AFMC MANPOWER ALLOCATION STRATEGIES

I. Introduction

Background

As Air Force budget dollars fluctuate due to changes in national military spending, Air Force major commands (MAJCOMS), such as Air Force Materiel Command (AFMC), are forced to reallocate resources. In some contexts, explicit directives from Air Staff make the resource reallocation straightforward. In other contexts, particularly in the manpower resource arena, this is not the case, and the burden of decision falls directly on MAJCOM shoulders. In AFMC's case, the organization specifically responsible for making manpower allocation recommendations is XPM, the manpower resources directorate.

The selection of manpower authorizations to adjust is a difficult decision making process. In the past, AFMC/XPM manpower reallocation exercises have been tedious. Varying constraints and guidelines during successive exercises made the search for a consistent, defining methodology for the process difficult. Yet, XPM decision makers have identified the need for an analysis approach, model, or tool that could help AFMC/XPM consider manpower resource prioritization in an integrated framework of economics, politics and war-fighting capability.

Several basic characteristics of manpower allocation exercises make the decision process an arduous one and provide requirements for any potential solution methodologies. They are as follows:

1. As is natural for any problem that alters resource levels, trade-offs must be made between multiple conflicting objectives. For AFMC, the conflicting factors are the command's many different organizations, whose effectiveness in performing militarily valuable missions will be impacted by manpower changes. The trade-off decisions that must be made are especially tough for AFMC since effectiveness is difficult to compare across diverse functional elements and programs.

2. The involvement in the decision making process of the diverse functional managers, or Mission Element Board (MEB) members, who feel strong ownership for "their" programs and manpower authorizations requires a methodology for iterative group decision making that gives quick answers and provides insight into what is driving end results.

3. One of the most difficult aspects of the prioritization problem is that any methodologies provided must be generic in application, since the specific problem parameters change from one exercise to the next. In other words, each time an allocation exercise takes place, there are different guidelines and constraints that govern what manpower changes can be made, and successful implementation of a solution technique in one instance does not imply success for future applications under different circumstances. Methodologies must be robust enough to incorporate different constraints for different

situations, but must be simple enough that decision makers can easily understand them and use them to model particular situations.

Problem Statement

AFMC/XPM resource managers have limited methodologies for assessing the impacts of competing manpower allocation alternatives on overall AFMC mission accomplishment. Without such information, they are often forced to recommend equal percentage changes across organizations.

Research Objective

It is the purpose of this research effort to develop a methodology that can be used by AFMC/XPM resource managers to compare the competing manpower allocation strategies developed during a resource allocation exercise.

Scope

This research does not attempt to develop manpower allocation alternatives for consideration by resource managers. Instead, it provides a methodology for comparing the alternatives generated during another phase of the decision making process. It is assumed that the parameters of the particular exercise and the constraints associated with it would be taken into consideration during the alternative development phase, and that only those alternatives which succeeded in meeting exercise constraints would be presented to this model.

Overview

Chapter II provides a review of the literature pertinent to a decision making approach called Value Focused Thinking.

Chapter III presents detailed background for the research conducted, describing AFMC and the process by which its manpower directorate, AFMC/XPM, develops resource allocation recommendations.

Chapter IV describes the methodology for developing the value model and presents a description of the model.

Chapter V presents the results of the research and analysis of those results.

Chapter VI contains conclusions drawn from the analysis in Chapter V and makes recommendations for additional research.

II. Literature Review

Introduction

The basic difficulty underlying the AFMC manpower decision making process is one of multiple conflicting objectives. AFMC has a specified mission to accomplish (refer to Chapter III), and it can be assumed that accomplishment of this mission with maximal effectiveness given available resources is the primary goal of the command. In actuality, the AFMC mission is comprised of many diverse functions, where the accomplishment of each can be viewed as a fundamental objective of the command. When AFMC is forced to make changes to existing command manpower resource levels to achieve mandated manpower endstrengths or meet budgetary constraints, the level of maximal AFMC mission effectiveness is bound to change, as will the level of attainment of each fundamental objective. If it is assumed that allocation of manpower toward a particular fundamental objective prohibits its use toward another objective, then necessarily the fundamental objectives will conflict. Since feasible manpower allocation alternatives do not allow high achievement of conflicting fundamental objectives simultaneously, decisions made in allocating manpower resources to meet new constraints must consider the importance of each fundamental objective in light of the primary command goal (3:431).

Many decision analysis techniques deal with the comparison of alternatives in making decisions with multiple conflicting objectives. One such methodology is particularly useful for making resource decisions because it focuses, not on the possible

alternatives, but on the values of the decision makers. Developed by prominent decision analyst Ralph Keeney, it is called Value-Focused Thinking (8).

Value-Focused Thinking

Value-Focused Thinking (VFT) is a straightforward way of dealing with conflicting objectives. Many typical decisions are made by decision makers taking stock of the available alternatives, assessing the pros and cons of each, and choosing the one that seems to result in the best trade-off among objectives. VFT takes a different approach. It stresses the importance of the objectives, instead of the alternatives, as it is the attainment of them that provides value to the decision maker. The primary goal is viewed as the combined achievement of some set of fundamental objectives. Each fundamental objective is broken into subobjectives, which in turn, are broken into sub-subobjectives until a complete model of the decision maker's objective hierarchy, called a value model, is created (8:77-87, 130-132).

Development of Value Models and Value Functions

Once a value model has been created, it can be represented by a mathematical value function, the purpose for which is the calculation of an overall value score for any decision alternative. Basically, value scores are calculated for each objective, weighted according to the relative importance of the various objectives, and summed¹ (3:431).

¹ Value functions are found in decision analysis literature under many names. Keeney and Raiffa provide a complete list, including preference functions and utility functions (7:68).

There are several steps in the formulation of a value function. The first step in the process, the determination of relevant objectives for building the value model objective hierarchy, has already been discussed. The next step involves measurement of the performance of competing alternatives in meeting the established value model objectives (3:431). This is accomplished through the assignment of a measurable attribute to each of the lowest-level objectives (7:49). Using the assigned attributes, each decision alternative is scored on the extent to which it satisfies the corresponding objective.

The development of appropriate attributes and scoring methods is necessarily specific to the task, or decision problem, at hand. In some instances, when measurable attributes cannot be found for lower-level objectives, it may be necessary to depend on subjective indexes, proxy attributes, or direct preference measurements.²

The final step in the value function development process requires the establishment of a weighting scheme reflecting the relative importance of each objective at each level in the hierarchy. Again, there are numerous ways of approaching this task. Subjective assessment of each objective's importance by decision makers is one possibility. Another method utilizes revealed preferences, where a decision maker's past actions and decisions are studied to derive a preference structure for current objectives. This technique is dependent on the assumption that a decision maker's choices in the past were directed towards achieving optimal solutions (7:18).

² Keeney and Raiffa provide a detailed discussion of these techniques (7:55-62).

Additive Value Function Assumptions

If the objectives in the value model hierarchy interact in any way (e.g., achievement in one area is dependent on achievement in another area, achievement in one area substitutes for failure in another area, achievement in one area grows synergistically with achievement in another area), the value model and its associated mathematical function can be very complex. Yet, a very simple value function form, associated with an additive value model, can be appropriate for many decision contexts if some basic assumptions are met (7:80). The following independence conditions must be satisfied for an additive value function to give an appropriate representation of the problem:

1. mutual preferential independence,
2. mutual utility independence, and
3. additive independence.

Preferential independence exists between attributes when preferences for sure outcomes in one attribute do not depend on the level of other attributes.³ The stricter condition of utility independence requires that preferences for gambles in one attribute do not depend on the other attribute levels. Additive independence is an even stronger requirement, where preferences over lotteries in one attribute must not depend on lotteries in other attributes⁴ (3:492). A consistency check for the use of an additive value function is that weights assigned across a set of subobjectives, reflecting the relative importance of those objectives, sum to one.

³ For mutuality, the relationship must hold in both directions.

⁴ A detailed description is given, along with examples and assessment strategies, of each independence condition (3:477-484).

III. Background

AFMC Manpower Structure

In 1991, two Air Force major commands, Air Force Logistics Command (AFLC) and Air Force Systems Command (AFSC) merged to form Air Force Materiel Command (AFMC), headquartered at Wright-Patterson Air Force Base, Ohio. The missions of both original commands were incorporated into a new mission, cited below:

Through the integrated management of research, development, test, acquisition, and support, we advance and use technology to acquire and sustain superior systems in partnership with our customers and suppliers. We perform continuous product and process improvement throughout the life cycle. As an integral part of the Air Force War Fighting Team, we contribute to affordable combat superiority, readiness and sustainability (14).

The former AFSC commander, General Ronald Yates, was given the reins of the newly formed AFMC. Since his assumption of command, General Yates has overseen several reorganizations and restructurings designed to better enable AFMC to use its allocated resources and fulfill its mission.

According to the most recent organizational restructuring (per AFMC Objective Blueprint dated 1 Oct 94), AFMC is responsible for managing and maintaining the fourteen Air Force Bases (or Air Bases) where the majority of its resources are located. The command is comprised of nineteen subcommands, in addition to the headquarters itself. Among these are the three well-known test centers (AEDC, AFDTC, and AFFTC), four product centers (ASC, ESC, HSC, SMC), and five air logistics centers (OC-ALC, OO-ALC, SA-ALC, SM-ALC, WR-ALC.) The remainder is comprised of a variety of smaller organizations such as the AMARC, AGMC, etc. Table 1 contains a complete

listing of AFMC subcommands. Subcommands are in turn divided into two-letter organizations.

Table 1. AFMC Subcommands

Arnold Engineering Development Center (AEDC)
Air Force Development Test Center (AFDTC)
Air Force Flight Test Center (AFFTC)
Air Force Museum (AFMUSEUM)
Air Force Security Assistance Center (AFSAC)
Aerospace Guidance and Metrology Center (AGMC)
Aerospace Maintenance and Regeneration Center (AMARC)
Aeronautical Systems Center (ASC)
Cataloging and Standardization Center (CASC)
Electronic Systems Center (ESC)
Field Operating Agencies (FOA)
Headquarters Air Force Materiel Command (HQAFMC)
Human Systems Center (HSC)
Joint Logistics Systems Center (JLSC)
Oklahoma City Air Logistics Center (OC-ALC)
Ogden Air Logistics Center (OO-ALC)
San Antonio Air Logistics Center (SA-ALC)
Sacramento Air Logistics Center (SM-ALC)
Space and Missile Systems Center (SMC)
Warner Robins Air Logistics Center (WR-ALC)

At first look, these subcommands appear to be clearly divided by mission area (e.g., test, product development, maintenance.) Indeed, from a resource allocation perspective, accomplishment of the AFMC mission, discussed previously, is divided into five primary mission element areas, as follow:

1. Product Management (PM),
2. Science and Technology (S&T),
3. Test and Evaluation (T&E),
4. Sustainment and Industrial Operations (S&IO), and

5. Base Operating Support (BOS).

For the most part, the mission of each subcommand, or center, falls directly under one of these mission element areas. There are, however, a few exceptions. The S&T mission element area incorporates the missions of AFMC's four laboratories, even though, structurally, they belong to each of the four product centers, and the BOS mission element area, by its very nature, incorporates any of the AFMC subcommands which depend on one of the AFMC Air Force bases for support. Table 2 depicts the relationship between the centers and the mission element areas.⁵ Each mission element area is overseen by a Mission Element Board (MEB) which represents the area's interests and resource requirements to the command.

Table 2. Relationship Between MEBs and AFMC Center Missions

PM	S&T	T&E	S&IO	BOS
ASC	ARMSTRONG LAB	AEDC	OC-ALC	AEDC
ESC	PHILLIPS LAB	AFDTC	OO-ALC	AFDTC
HSC	ROME LAB	AFFTC	SA-ALC	AFFTC
SMC	WRIGHT LAB		SM-ALC	AFMUSEUM
			WR-ALC	AFSAC
				AGMC
				ASC
				CASC
				ESC
				FOA
				HQAFMC
				HSC
				OC-ALC
				OO-ALC
				SA-ALC
				SM-ALC
				SMC
				WR-ALC

⁵ For the purpose of this research, AFMC's laboratories are treated as centers, even though they do not bear a center designation.

Although the MEB structure provides clear definition for certain types of resource allocation, difficulties begin to arise when this command structure is viewed with a focus on manpower allocation. Although the majority of manpower authorizations at each subcommand fall under its primary mission area, each subcommand can own positions that fall in each of the other areas. This is due to the fact that manpower positions are managed, not according to the command's organizational structure, but by program element code, or PEC. PECs are the funding codes that tie manpower authorizations to Air Force (DOD) program dollars. It is the AFMC PECs that are divided into mission element areas for MEB management; thus, manpower authorizations must be managed and assigned by MEB, also. Since a single subcommand can be involved with work on many funded program elements, it is often the case that it ends up with manpower resources belonging to different MEBs.

Making matters even more complex, manpower positions can be viewed and managed for some purposes from yet another orientation, that is, by functional account code, or FAC. Some examples of AFMC functional areas are logistics, engineering, and contracting. It is easy to see that AFMC, from a manpower standpoint, is not so neatly defined as may be thought at first glance.

AFMC Manpower Data

Currently, AFMC/XPM is responsible for over 150,000 manpower authorizations. Managing all of these resources requires a tracking system that provides insight into manpower allocation by the previously discussed organizational structure, mission areas, and program element codes (PECs) as well as many other factors. The Command

Manpower Database, or CMDB, is the tool that is used. This database, which is updated quarterly, contains a record for every AFMC authorization. It contains information on existing command manpower authorizations as well as projections for resource levels several years into the future. Thirty data fields for each record provide access to required information pertaining to a particular authorization.

The information contained in the CMDB is used by AFMC/XPM for an entire realm of manpower actions and decisions. Only a subset of this information is required for making the decisions involved in a mandated manpower allocation exercise. Therefore, the fields utilized in this research are limited to the following: Mission Element Board (MEB), subcommand, laboratory name, organizational structure code (two-letter organization), base location name, functional account code (FAC), program element code (PEC), and current year authorization.

Manpower Allocation Process

Major manpower allocation decisions are made at the command level (i.e., AFMC) in response to mandate by senior Air Force leadership, as well as to needs identified within the AFMC command structure. As the command's Organization and Manpower Directorate, AFMC/XPM is responsible for conducting manpower allocation exercises to support the command's decision making process. The goal is identification of potential solution alternatives for recommendation to senior leadership. Although this responsibility lies with XPM, the manpower resources are "owned" by the center and organization commanders. Their involvement in manpower allocation exercises and subsequent decision making efforts is facilitated through the five Mission Element Boards (MEBs),

the chairpersons of which forward their interests and resource requirements to the command senior leadership. Since each MEB is comprised of all subcommand (center) commanders with resources in that mission element area, it is chaired by the two-letter organization at the HQ AFMC level that is appropriately related to that mission area. Thus, the MEB chairpersons form the link between the organizational structure of the command and the superimposed mission element structure by which resources are managed. The relationships between HQ AFMC two-letter commanders and the five MEBs are depicted in Table 3.

Table 3. Relationship Between HQ AFMC Two-letter Commanders and MEBs

<u>HQ AFMC Two-letter Commander</u>	<u>Chairs MEB</u>
XR	PM
ST	S&T
DO	T&E
LG	S&IO
CE	BOS

The process by which AFMC/XPM conducts a major manpower allocation exercise begins with a Resource Allocation - In Process Team (RA-IPT) being formed to ensure that all interested parties are involved. Although the five MEB chairpersons, or "chiefs", function as the RA-IPT's sole voting members, attendance and input from the remaining HQ AFMC two-letter organizations is welcome. AFMC/XPM presents the requirements of a particular exercise to the RA-IPT members. They work together to generate viable manpower allocation alternatives for evaluation by command leadership, attempting to balance the needs of each of the RA-IPT's voting members and the MEBs they represent while meeting the constraints presented by the particular exercise. An iterative process

continues with XPM formulating explicit numerical solutions to represent the more general decisions made during RA-IPT meetings and presenting them back to the RA-IPT for acceptance. This loop is often repeated several times, requiring an extensive expenditure of time and effort by the XPM resource managers.

One of the reasons this process is so time and effort consuming is that within the framework of any manpower allocation exercise, the requirements and constraints to be taken into consideration can be very involved. For instance, a manpower adjustment target may come down from Air Staff in the form of a monetary value or in the form of a manpower endstrength to be reached by some fiscal year point. The particular programs affected may or may not be specified. Sometimes only specific manpower categories (i.e., officer/enlisted/civilian) or types of organizations (e.g., those with DMBA funds) are targeted. Organizations may be fenced, or removed from consideration, even though their resources match the requirements of the exercise in every way. The complicated constraint framework and lengthy RA-IPT process has frustrated XPM resource managers for years. A frequent fallback position, simplifying the situation, has been a peanut butter spread allocation across all viable organizations.⁶ Yet, intuition postulates that this is not near an ideal solution where the logical goal is attainment of optimal command performance with a given set of manpower resources. Thus, although this and other XPM alternatives have been accepted by the RA-IPT and implemented by command decision makers, there is a feeling that with added insight, XPM resource managers could find and present better solutions.

⁶ AFMC/XPM refers to an equal percentage allocation across all organizations as a peanut butter spread.

Model Context

Any modeling tool developed for providing assistance to AFMC/XPM during a manpower allocation exercise should focus on the following:

1. Simplifying the framework of requirements and constraints to be handled,
2. Shortening/automating the lengthy RA-IPT process, and
3. Providing insight into the relationship between AFMC manpower resources and the command's ability to perform its mission.

The former parts of this problem are addressed by another research effort.⁷ The third goal above is the focus of this research effort and the associated model.

⁷ A study is currently being done to automate the reduction of manpower authorizations considered during the RA-IPT process to meet the constraints and parameters of a particular allocation exercise (2).

IV. Methodology

Value Model Development and Description

This research effort uses a Value Focused Thinking (VFT) approach because of its ability to model overall AFMC command mission effectiveness as a function of the mission effectiveness of the command's smaller organizations. The value model can be depicted as a tree hierarchy representing a fundamental objective repeatedly divided into subobjectives until quantifiable attributes are reached at the lowest tier. This tree representation allows insight into the role each element of the hierarchy plays in contributing to the overall objective; in this case, overall AFMC mission effectiveness. The complete value model developed for this study is presented in Appendix A.

TIER I. The top tier, or Tier I, of the value model represents the entire AFMC command, whose optimal mission effectiveness in the face of constrained resources is the fundamental objective to be captured. If the concept of overall command effectiveness as related to manpower allocation were easily quantifiable at this level, the value tree representation could be terminated at the top tier. Command level decision makers could calculate the impact of all manpower allocation alternatives and choose the best one. Yet, it has already been determined that this is not the case. Command decision makers do not simply hand down guidance for manpower allocation each time a resource change is mandated. Instead, they require the time and effort intensive insight into the decision making process that is provided through AFMC/XPM and the RA-IPT conducting a manpower allocation exercise. Thus, another tier in the value model hierarchy is required.

TIER II. The choice of a breakdown strategy to be employed at Tier II appears straightforward. Since the AFMC/XPM manpower allocation exercise process is undertaken with a viewpoint of the command and its resource requirements by mission element area, the division of AFMC in the value model by MEB is an ideal choice. The ensuing value model tier represents five subobjectives, each of which is the attainment of optimal MEB mission effectiveness in the face of constrained resources.

At this point, it is again important to consider whether or not the relationship between manpower and achievement of these subobjectives is easily quantifiable. If it were, MEB chiefs could easily assess the impacts of manpower changes on the abilities of the center and organizations they represent to sustain their respective missions. Resulting assessments, summed across the five MEBs and weighted relative to each MEB's importance to the command, would represent overall command effectiveness. There would be no need to model further; but again, this is not the case. As mentioned in Chapter III, each MEB represents multiple subcommands. With the enormous variety of mission functions performed by each subcommand, there is little chance that a single MEB chief could have the insight required to successfully evaluate manpower allocation alternatives; thus, it is necessary to continue developing the model to a level where quantification of the relationship between manpower allocation and mission effectiveness is achievable.

TIER III. A strategy for further division of the MEBs is not quite as obvious as the one presented at the previous tier. However, recalling that each MEB is comprised of the primary subcommand, or center, commanders whose resources fall in that mission element

area, an appropriate choice for a Tier III division would seem to be each of the centers employing MEB resources. Although most of the resources in an MEB are assigned to one of its primary centers (refer to Table 1), due to the complexity of the MEB structure, some MEB resources fall outside those centers. In addition, some centers are primary resource owners in more than one MEB, typically BOS and one other MEB. This does not pose a problem as long as the model is carefully set up to distinguish between manpower authorizations that belong in each MEB and not duplicate them. Within each MEB, resources not captured by one of the primary Tier III centers are combined and evaluated as a single additional center. (Refer to the next section for assumptions and simplifications.)

Following the model pattern established by the existing tiers, it is possible to characterize the value of Tier III, again, as a series of subobjectives, each one being a center's mission effectiveness in the face of constrained resources. The first three tiers of the value model are shown in Figure 1.

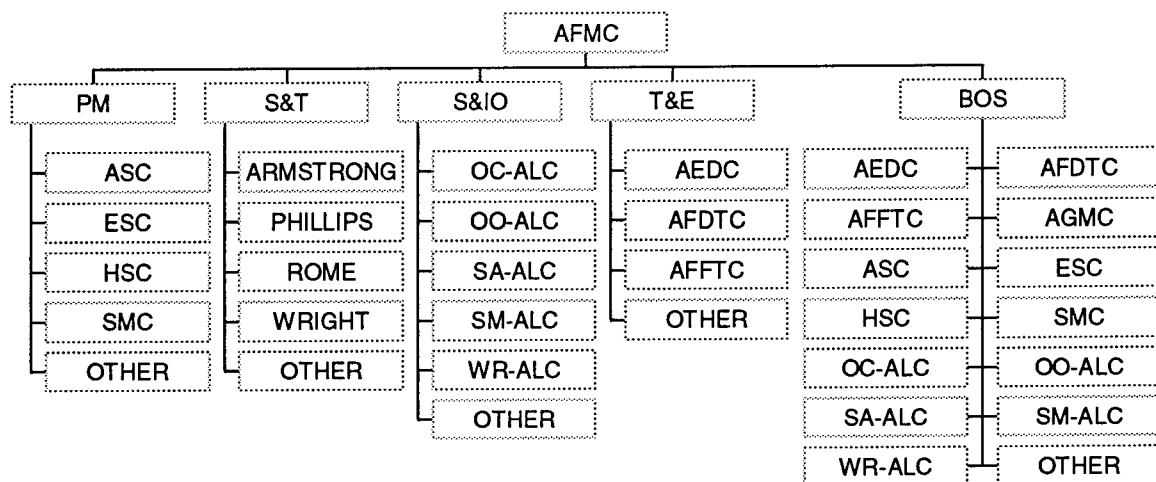


Figure 1. Upper Tiers of the Value Model

Once again, it is advantageous to consider whether or not further breakdown of the value tree is necessary, or if quantification of the relationship between manpower allocation and mission effectiveness is possible at this level. The problem with quantification at this tier is that centers, although more narrowly focused than MEBs or major commands, still encompass many smaller organizations whose missions span a variety of programmatic and functional areas. Further breakdown into units with unique, narrowly directed missions that provide access to performance measurement is required.

TIER IV. Recalling earlier discussion, several potential choices for the division of Tier III centers are apparent, including breakdown by functional account code (FAC), program element code (PEC) and structural organization (two-letter). The following are the requirements considered in the selection of a Tier IV breakdown strategy:

1. There exists, conceptually, some appropriate measure of effectiveness (MOE), or metric, for explicitly assessing the impact of a manpower change on mission effectiveness for each Tier IV unit.

2. There exists, realistically, the available data or subjective insight required for utilization of the selected MOE.

3. Mutually exclusive and collectively exhaustive incorporation of all AFMC manpower assets is feasible at Tier IV using this breakdown scheme.

After in-depth evaluation of the ability of each potential breakdown scheme to meet these requirements, Tier IV breakdown by organizational structure, (two-letter organization), was selected as the most viable approach.

In general, the FAC code alternative fell short of meeting the first two requirements. Functional accounts, of which there are 1,317 in AFMC, identify "homogeneous groupings of tasks" (14). They are inherently detailed and explicit, providing insight into the types of skills required by different manpower authorizations. Basically, there are no metrics for mission effectiveness at such a detailed level, and the level of responsibility for, and thus visibility into, mission accomplishment may encompass any number and variety of FAC codes.

On the other hand, with only 279 program elements in AFMC, each seemingly possessing a tie to program importance at the AF/DOD budget level, PEC code seems an ideal basis for Tier IV breakdown. However, the PEC breakdown alternative also falls short on the first two requirements. Interviews with HQ AFMC MEB focal points for program and organizational metrics were helpful in determining that metrics for mission effectiveness, and responsibility for mission accomplishment, do not exist at the individual PEC level (1; 4; 11; 12).

Although it has none of the inherent attractiveness that functional or program related schemes have, breakout by organizational structure, or two-letter organization, successfully meets each of the above requirements. Due to the very nature of the two-letter as the fundamental building block of AFMC's organizational structure, subjective assessment of the impact of manpower changes on effectiveness in performing a unique and narrowly scoped mission is attainable, if from none other than the two-letter organization's commander/director. In addition, the model for the Tier IV breakdown as a mutually exclusive and collectively exhaustive set already exists as the command's

organizational structure. However, since inclusion of AFMC's 741 total two-letter organizations would require excessive data collection from busy organization commanders, Tier IV will be handled in a similar manner to Tier III. Only the two-letter organizations employing the majority of the manpower resources in each center are modeled explicitly. The other two-letter organizations at each center are combined and incorporated as a single two-letter organization, resulting in a total of 268 Tier IV organizations.

Model Assumptions and Simplifications

It is necessary to make certain assumptions and simplifications in order to complete the development of the value model. They are as follows:

1. Model outcomes are based on organizational manpower totals including officer, enlisted, civilian, and contracted military equivalent (CME) authorizations. Although CME positions are untouchable during a manpower resource allocation exercise, they reflect an existing level of effort being applied toward organizational mission accomplishment, and thus are considered in establishing weights and determining current manpower levels.

2. The HQAFMC subcommand is excluded from this study, since manpower resource allocation to the headquarters is not controlled by the RA-IPT process at which this research is directed.⁸

⁸ HQ AFMC resources are only 1.23% of total AFMC manpower resources.

3. It is not necessary to explicitly model every organization at every tier. As long as the majority of organizations with large numbers of manpower resources are modeled explicitly, the remaining small organizations can be grouped as an individual unit without loss of insight.

4. An additive value function is used to mathematically represent the value model since the required assumptions of preferential, utility, and additive independence appear to make good sense. Specifically, for any modeled organization, a large allocation of manpower should be preferred to a small one, regardless of the manpower allocation levels in other organizations.

5. As discussed in Chapter II, typical value model applications rely on a two-step process for quantification of values at the bottom tier of the model (i.e., assigning a quantifiable attribute to each two-letter and then measuring the organization's performance against it for any allocation alternative.) In lieu of this, the ability of each organization to perform its mission based on allocated manpower is captured directly by subjective assessment.

6. Data collected from the field relies on an implicit understanding of the concept of 100% mission effectiveness as a level of accomplishment coincident with an appropriate quality of performance (e.g., no excessive backlog is created; nor is the level of service above what is actually required.) It also requires an understanding that manpower resource levels identified as being able to achieve a certain level of mission effectiveness should be those that can sustain that level of effectiveness for an indefinite period of time.

Tier IV Value Quantification

The purpose in constructing the value model hierarchy is to enable XPM resource managers to gain insight into the “unquantifiable” AFMC command (Tier I) mission effectiveness in terms of “quantifiable” two-letter organization (Tier IV) mission effectiveness. Thus, it is necessary to develop a measure of the value that each Tier IV organization provides. This can be accomplished for each using a scoring function, which essentially maps the manpower level attributed to a two-letter organization (by an allocation alternative) to a mission effectiveness value, based on the relationship of manpower and mission effectiveness in that two-letter.

Scoring Functions. The scoring functions used in this research to relate two-letter organization manpower level to mission effectiveness are of the following four types: linear, concave, convex, and S-curve. Figure 2 demonstrates the shape of each of these functions.

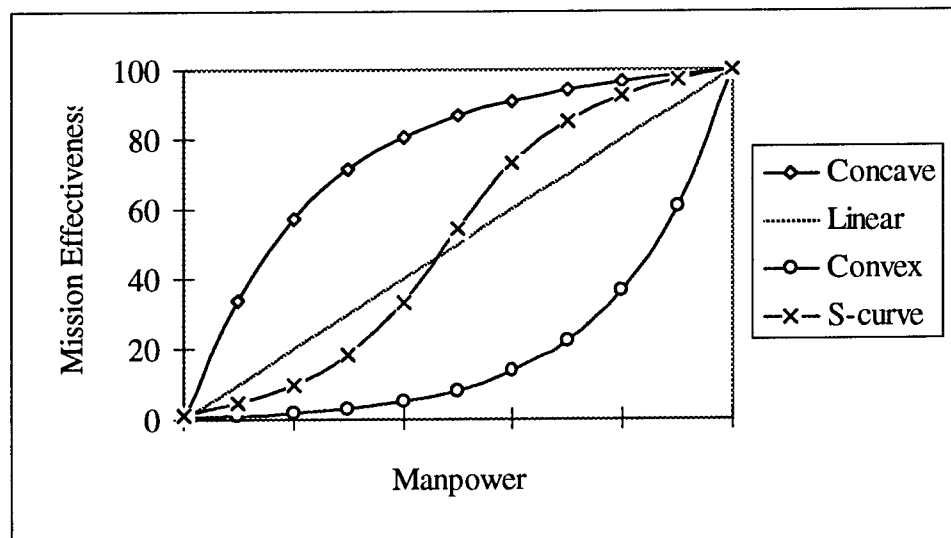


Figure 2. Sample Scoring Functions

A convex scoring function is used to model value for organizations that experience major improvements in effectiveness for minor increases in manpower when manpower levels are close to optimal (i.e., at the top of the curve.) At the opposite extreme, a concave function is used to model value for organizations that experience minor improvements in effectiveness for major increases in manpower when manpower levels are close to optimal. A linear scoring function represents an equivalent percentage change in effectiveness per change in manpower, regardless of the manpower level. The S-curve combines each of the previous functions at different points (i.e., convex for low manpower levels, concave for high manpower levels, and linear in between.) As an example, the S-curve would be appropriate for modeling the value of an organization that requires a fair manpower allocation for any effectiveness to occur but receives diminishing returns in effectiveness for manpower increases at high manpower levels.

In order to determine which of the above types of curves is appropriate for each Tier IV two-letter and to derive the specific parameters of the scoring functions for each, it is necessary to capture the relationship that exists between manpower and mission effectiveness in each two-letter organization. Appropriately, the Tier IV breakdown methodology was chosen primarily due to the availability of subjective insight into this relationship. A mission effectiveness survey was developed as a tool for gaining the required information directly from each two-letter organization commander/director. Assistance from AFMC/XPM's modeling support team was sought in developing

appropriate survey questions. (5; 6; 13; 14) The resulting mission effectiveness survey and the survey responses collected are included as Appendices B and C.⁹

After the survey data was collected, a mathematical applications package was used to derive appropriately shaped polynomial curves or piecewise linear functions as scoring functions for each Tier IV organization.¹⁰ Lower and upper bounds exist for each organization's scoring function. The lower bound occurs at the level of manpower below which the organization is effectively broken. The upper bound is the manpower level at which 100% mission effectiveness is attained. Manpower allocations outside these bounds result in scores of 0 and 100, respectively. Coefficients and bounds for each scoring function are shown in Appendix D.

Since scoring functions could only be assessed directly from the data for Tier IV two-letters who returned mission effectiveness surveys, alternative ways of developing scoring functions had to be developed for the remaining organizations. Development methodologies fall into the following four categories:

1. Category 1 consists of two-letter organizations modeled explicitly at Tier IV, for which data was attainable. Scoring functions were developed directly from the collected data.
2. Category 2 consists of two-letter organizations modeled explicitly at Tier IV, for which data was unattainable. Scoring functions for these two-letters were patterned after those of category 1 organizations with similar organizational functions.

⁹ Survey responses were obtained indirectly from two-letter commanders/directors by AFMC/XPM mission element area liaisons.

¹⁰ Mathcad® 4.0 (9).

3. Category 3 represents the two-letter organizations combined and modeled as single organizations within each center. Scoring functions were developed using data averaged across category 1 organizations in the respective center.

4. Category 4 represents the centers combined and modeled as single organizations within each MEB. These scoring functions were developed using data averaged across category 1 organizations in the respective MEB.

Table 4 and Figure 3 show the percentage of AFMC resources that fall into each of the four categories.

Table 4. Resources by Scoring Function Development Category

CAT4	16%	5%	2%	8%	3%	7%
CAT3	6%	7%	14%	2%	26%	10%
CAT2	8%	85%	31%	39%	37%	36%
CAT1	70%	3%	53%	51%	34%	47%
	PM	ST	TE	SIO	BOS	TOTAL

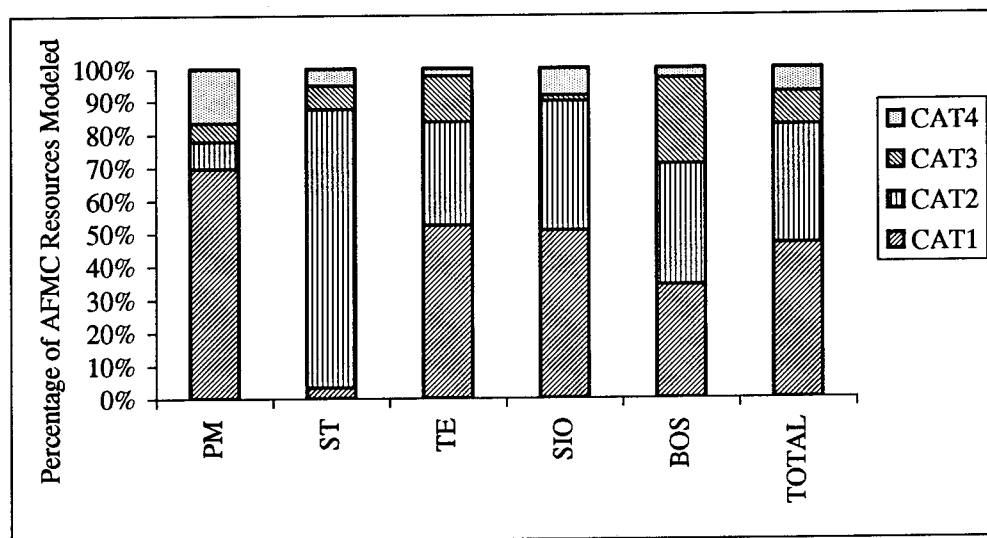


Figure 3. Resources by Scoring Function Development Category

Value Model Weights

As discussed in Chapter II, the final step in the value function development process is the establishment of a weighting scheme that reflects the relative importance of each objective at each tier in the hierarchy. Since computation of the overall value to AFMC of a particular manpower allocation strategy relies on the weighting factors used, it is important that the selection of weights be given careful thought. Recall that Tiers II through IV of the model hierarchy represent subobjectives, and that achievement of any subobjective contributes to the achievement of its parent objective at the tier above. When it seems plausible that all subobjectives do not provide equal contributions to the objective above them, it is necessary to adjust weights to relate the importance of each's contribution. If, on the other hand, all subobjectives seem to carry equal significance, then weights should be held equivalent for respective organizations.

For the purposes of this research (i.e., in order to retain the most flexibility for XPM resource managers and the RA-IPT participants in utilizing this value model), a fixed weighting scheme will not be established. Rather, weights will be treated as model inputs, and the impacts of different schemes will be evaluated. The determination of model input weights can be performed subjectively by XPM resource managers or RA-IPT members. Guidance from command decision makers about the importance of MEBs, programs, or organizations should provide a foundation for establishing weights. In the case that model users do not have an appropriate feel for model weights, an assessment using revealed

preferences can be performed.¹¹ The only restriction, imposed by the use of the additive value function, is that the subobjective weights beneath any objective must be positive and sum to one.

Mathematical Value Model

Once the framework of the value model is complete, an associated mathematical function can be established, and an overall value, or score, can be computed for any manpower allocation alternative. The score calculated for any alternative represents the mission effectiveness obtained at the AFMC command level with manpower resources accordingly distributed. Thus, competing strategies, or alternatives, can be compared to determine which provides the highest overall value.

Using an additive value function, overall AFMC value is calculated as a weighted sum of the values at the next tier in the hierarchy, which in turn are calculated as weighted sums of the values at the tiers below them.¹² If explicit representation of all AFMC organizations existed in the value model, the resultant mathematical function would be as shown in Equation (1):

$$U(x_a) = \sum_{m=1}^5 w_m \cdot \sum_{c=1}^{C_m} w_{mc} \cdot \sum_{t=1}^{T_c} w_{mct} \cdot U_{mct}(x_{amct}) \quad (1)$$

where: a = manpower allocation alternative, $1 \leq a \leq n$ (n is the number of manpower allocation alternatives generated during the RA-IPT process)

¹¹ One method of determining relative importance of subobjectives is by revealed preferences. (Refer to Chapter II for a discussion of revealed preferences.) In this context, revealed preferences can be determined by studying the manpower levels currently assigned to each value model organization. The manpower assigned reflects the relative importance of the mission of that organization, and thus the importance of its contribution to the model. Model weights established in this manner are included as part of the complete value model shown in Appendix A.

¹² Refer to Chapter II for a discussion of the additive value function and its underlying assumptions.

w's = weighting factors

m = mission element area, $1 \leq m \leq 5$

c = center, C_m = number of centers with manpower resources in mission element area m

t = two-letter organization, T_c = number of two-letter organizations in center c

$U_{mct}(x_{amct})$ = mission effectiveness value of two-letter organization given the manpower resources allotted by alternative a

This representation must, of course, be modified, since explicit representation of all organizations at Tiers III and IV was deemed unnecessary for the purposes of this research. A more appropriate mathematical function for the value model is presented in Equation (2):

$$U(x_a) = \sum_{m=1}^5 W_m \cdot \left[\sum_{c=1}^{C_m-1} W_{mc} \cdot \left[\sum_{t=1}^{T_c-1} W_{mct} \cdot U_{mct}(x_{amct}) + W_{mT_c} \cdot U_{mc}(x_{amc}) \right] + W_{mC_m} \cdot U_m(x_{am}) \right] \quad (2)$$

where: $U_m(x_{am})$ = value of combination center, comprised of centers not explicitly modeled at Tier III, given the manpower resources allotted by alternative a

$U_{mc}(x_{amc})$ = value of combination two-letter organization, comprised of two-letter organizations not explicitly modeled at Tier IV, given the manpower resources allotted by alternative a

A computer spreadsheet application is used to compute the overall value scores, for any manpower allocation alternative.¹³

¹³ Microsoft® Excel, Version 5.0 (10).

V. Results

The objective of this research effort was to develop a methodology that can be used by AFMC/XPM resource managers in comparing the competing manpower allocation strategies developed by the RA-IPT during a resource allocation exercise. Thus, in order to demonstrate the capability of the value model developed, it should be used to compute value scores for manpower allocation strategies for a particular allocation exercise. However, without the specific parameters of a particular exercise at hand, (i.e., without alternatives developed to meet a mandated manpower increase or reduction target,) the model is without a vital input.

Yet, it is possible, using a few example allocation alternatives, to determine how the model will behave. Several strategies can be demonstrated in choosing example manpower levels, providing additional insight into the type of strategies that are most profitable in terms of achieving overall command effectiveness. The following are some applicable strategies:

1. Manpower allocation alternatives are based on organizational mission effectiveness. Each organization is allotted no more than it needs to improve to 100% mission effectiveness (manpower increases) and is reduced by no more than it can give and still function minimally (manpower reductions).
2. Changes in manpower allocations are taken as equal percentages of current manpower levels across all AFMC organizations, regardless of impact on mission effectiveness. This is the aforementioned peanut butter spread methodology.

3. Organizations are allotted manpower based on their importance, reflected by value model weights, or some other subjective ranking system.

The remainder of this chapter focuses on comparing the results of example alternatives generated according to these strategies, thereby assessing their viability in different circumstances. Model sensitivity to input weights is also considered.

Current Manpower Allocation

Important information can always be gained by running the model using currently assigned manpower levels to represent one of the allocation strategies. The model outcome resulting from the current assignment of AFMC manpower provides a measure against which all other strategies should be compared. For instance, if a manpower increase is mandated, the model output values associated with all competing strategies should be higher than the value obtained with the current manpower allocation. The best choice, assuming that maximal AFMC mission effectiveness is always the primary goal, would be the allocation strategy that results in the largest magnitude improvement over the current value. The same philosophy works for a mandated reduction in command manpower; however, instead of looking for the largest gain in value, the best choice would be the alternative resulting in the smallest value score diminishment. Current manpower levels are listed for all Tier IV organizations in Appendix E.

Allocation Based on Mission Effectiveness

Recall that for each Tier IV two-letter, lower and upper bounds exist at the points where the organization effectively breaks or achieves 100% mission effectiveness,

respectively. (Lower and upper bound manpower levels are also listed in Appendix E.) Meaningful insight can be gained by running the model on allocation alternatives in which each organization is provided with the manpower level required to function at each of those bounds. Overall value model output scores from these two runs reflect both the overall percentage increase in command manpower needed to raise all organizations to 100% mission effectiveness, and the overall percentage reduction that can be sustained without breaking any organization. Table 5 shows value model scores (using revealed preferences as a basis for weights) for these two allocation alternatives, as well as for the current manpower allocation. The percentage changes from overall current manpower level associated with each are included.

Table 5. Value Model Scores Using Revealed Preference Weights

Manpower Level	Value Model Score	Percentage Change in AFMC Manpower
Upper Bound	100	10.3% Increase
Current	84.65	-----
Lower Bound	65.3	21.8% Decrease

Similar information can be obtained at any level of the value model hierarchy simply by analyzing the scoring function upper and lower manpower level bounds for the organizations of interest. Since development of a complete manpower allocation alternative to present to decision makers begins with manpower distribution at the MEB level, insight into the requirements of the MEBs should be helpful. Table 6 decomposes the information contained in Table 5 by MEB.

Table 6. Acceptable AFMC Percentage Manpower Changes by MEB

MEB	Increase Required to Reach 100% Mission Effectiveness	Decrease Sustainable to Prohibit Organizational Breakage
PM	1.30	2.42
S&T	0.48	0.92
T&E	0.71	2.95
S&IO	5.26	10.59
BOS	2.53	4.91
TOTAL	10.27	21.79

Figure 4 demonstrates graphically the percentage changes in AFMC manpower that can be sustained by each MEB.

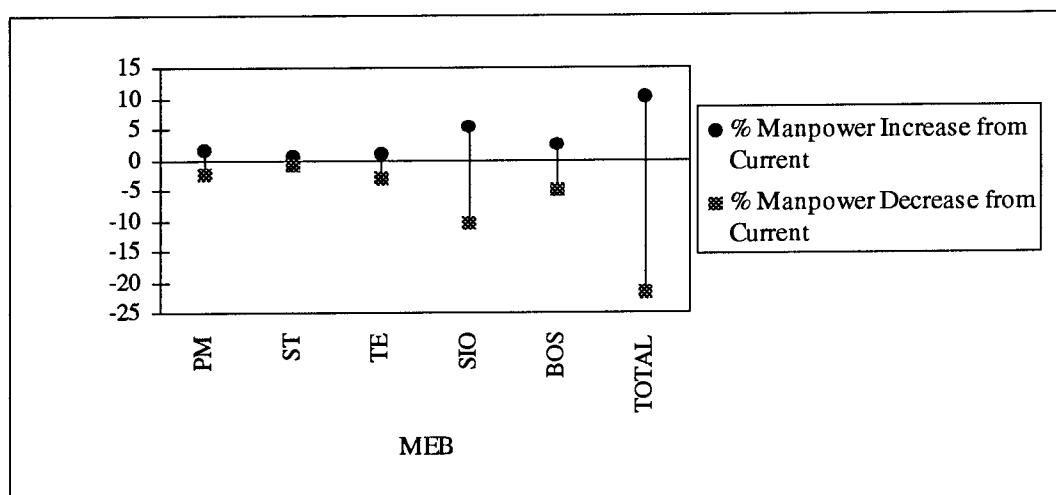


Figure 4. Acceptable AFMC Percentage Manpower Changes by MEB

Allocation Based on Equal Percentages

XPM has successfully performed many previous resource allocation exercises, and although each exercise dealt with different parameters and faced different constraints, some basic strategies were always among those used by the RA-IPT. Among them, one

of the most basic is the peanut butter spread, or equal percentage change across all viable AFMC organizations (14).

For this research, model output values were calculated for the following four alternatives and compared against the value obtained for the current allocation of AFMC manpower resources:

1. 5 % increase allocated as a peanut butter spread across all AFMC organizations
2. 5 % decrease allocated as a peanut butter spread across all AFMC organizations
3. 10 % decrease allocated as a peanut butter spread across all AFMC organizations
4. 15 % decrease allocated as a peanut butter spread across all AFMC organizations

The manpower levels associated with each allocation alternative, for all Tier IV organizations, are included in Appendix E. The model output scores, using model weights based on revealed preferences, are plotted, along with the scores generated in the previous section, in Figure 5.

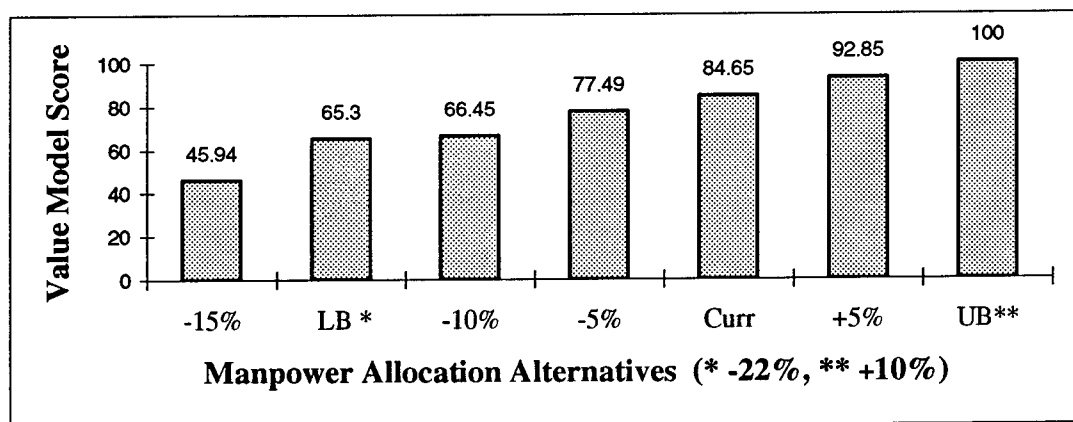


Figure 5. Value Model Scores for Allocation Alternatives

It is immediately obvious from this graph that peanut butter spread cuts do not provide the most efficient use of constrained resources when the goal is the best attainable level of command mission effectiveness. When taking cuts with respect to organizational manpower requirements for achieving mission effectiveness, an overall 21.8% (corresponding to a lower bound alternative) of command resources can be taken without breaking any organizations, resulting in a value score of 65.30. This is comparable damage to mission effectiveness as results from a peanut butter spread of only 10%. A reduction of 15% of command resources, when distributed using a peanut butter spread reduction, results in an even lower value score of 45.94.

In addition, unlike the alternatives produced by evaluating the exact needs of value model organizations, percentage cuts across the command do not ensure that all organizations are able to operate within appropriate mission effectiveness ranges, if at all. Percentage increases may raise the manpower of some organizations beyond levels required to reach 100% mission effectiveness, in effect, wasting manpower that could be more efficiently utilized by other organizations. Similarly, percentage decreases may effectively break some organizations, while barely impacting others. This does not imply that such allocation alternatives are bad by design, as there may be circumstances where it is appropriate to let some organizations suffer to keep others operating at desired levels. Figure 6 shows the percentage of resources belonging to organizations that are no longer able to operate as percentage reductions are taken as peanut butter spreads across AFMC organizations.

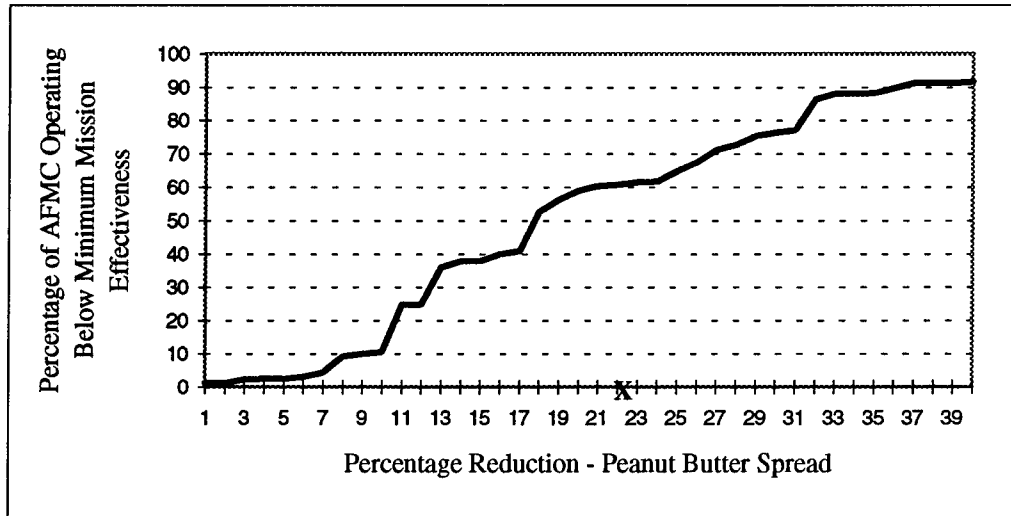


Figure 6. Organizations Broken Per Percentage Manpower Reduction

The X marked on the Figure 6 axis shows the maximum percentage reduction that still enables all command resources to operate, albeit at minimal effectiveness, when allocation is done according to organizational requirements rather than by peanut butter spread. A dramatically higher overall percentage of resources can be lost with reductions taken in accordance with organizational requirements.

Figure 7 shows the percentage of resources belonging to organizations that are able to operate at 100% mission effectiveness as percentage increases are spread across AFMC organizations.

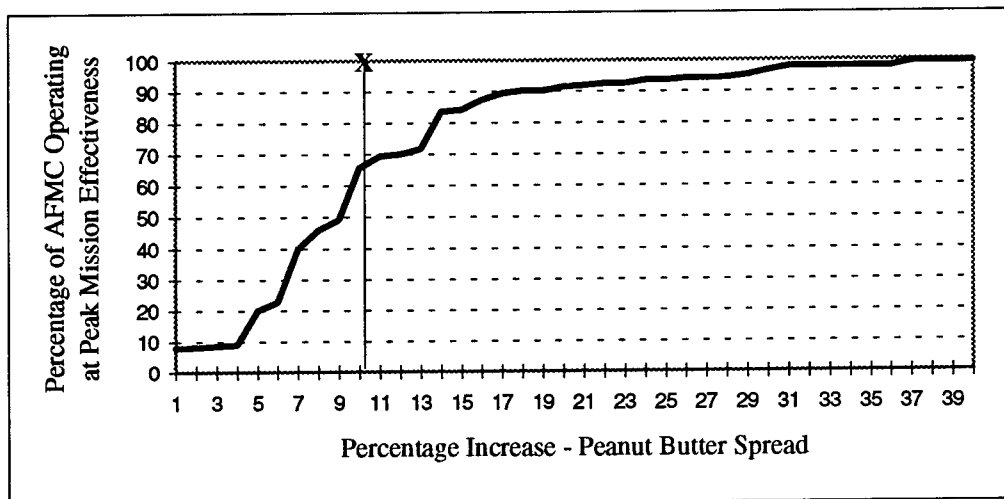


Figure 7. Peak Effectiveness Gained Per Percentage Manpower Increase

The X marked on Figure 7 shows the minimum percentage increase that enables all command resources to operate, at 100% mission effectiveness, when allocation is done according to organizational requirements rather than by peanut butter spread. Note that, in this case, it requires considerably fewer resources to operate at maximal command effectiveness when the requirements of individual organizations are taken into consideration.

Allocation Based on Organizational Importance (Model Weights)

As mentioned previously, there may be times when it is more valuable to AFMC to let the missions of certain (less important) organizations suffer so that other (more important) organizations may retain high levels of mission effectiveness. One feasible allocation alternative that fits this strategy, for manpower reductions, is to cut lowest priority organizations entirely so that others do not have to give up resources. The flip

side of this alternative, for manpower increases, is to allocate resources to highest priority organizations first, enabling them to achieve 100% mission effectiveness before allocations are given to organizations with lower priorities.

However, allocation alternatives of this type necessitate that an evaluation of an organization's importance be made in relation to other organizations. Recall that model weights developed using revealed preferences reflect the relative importance of the subobjectives at any model tier. Thus, in effect, they reflect the relative importance of the organizations. Rank ordering two-letters by their overall weights gives a prioritized list of AFMC organizations.

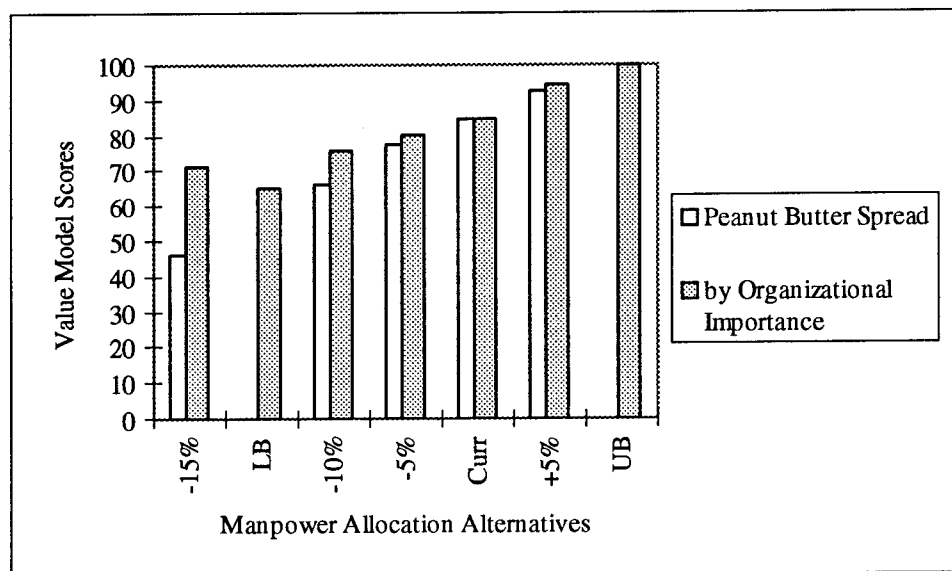


Figure 8. Comparison of Value Model Scores

Figure 8 shows the value scores attained when resources are prioritized by model weights, for the same overall percentage changes used in each of the four peanut butter spread

alternatives. Scores for upper and lower bounds are not affected, since in order to reach either bound, manpower levels in every organization in the ranking is impacted to the greatest extent possible. The graph reveals that manpower allocation alternatives generated with respect to organizational importance, as reflected by model weights, outperform peanut butter spread alternatives in achieving higher levels of AFMC mission effectiveness. Of course, deleting entire organizations, regardless of their priority ranking, may not be suitable, even if it does result in high value model scores. Thus, the requirements of the specific resource allocation exercise must still come into play during the alternative generation process.

Model Sensitivity to Input Weights

It is important to get a feel for the impact that different weighting schemes might have on model behavior. Thus far, all value model output scores have been obtained using the revealed preference weights to reflect the relative importance of organizations. Insight can be gained by comparing model output scores using these weights to output scores using equal weights at some or all model tiers. Previous scores obtained for current manpower level, upper and lower manpower bounds, and the four peanut butter spread alternatives are replotted in Figure 9 along with scores generated using equal subobjective weights at all model tiers.

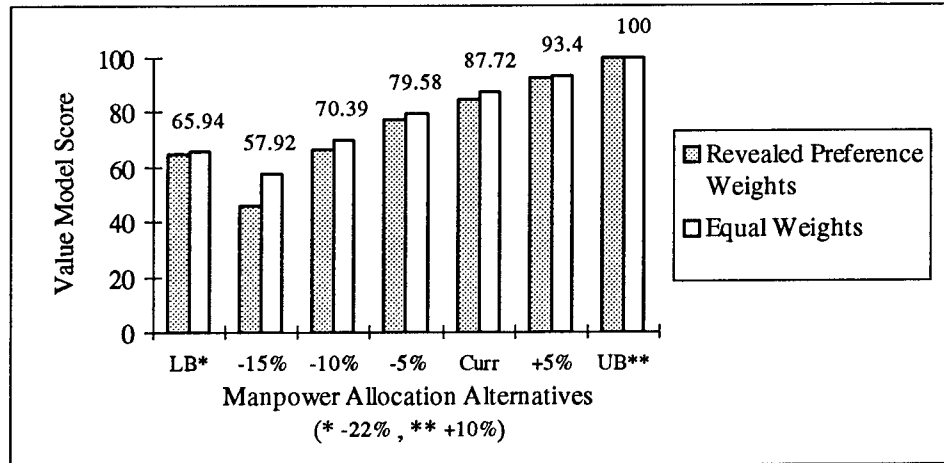


Figure 9. Comparison of Scores Using Different Weighting Schemes

The values at the column tops in Figure 9 are the new scores computed with equal weights. In general, the different weighting schemes do not appear to have a tremendous impact on the magnitudes of the model output values; however, it is important to analyze what is driving the differences. Results like this will be seen when there is a discrepancy in the mission effectiveness levels of high priority versus low priority organizations. High priority organizations with low mission effectiveness levels will have a severe (decreasing) impact on value scores when revealed preference weights are used. When equal weights are substituted, value scores will increase, since those organizations will no longer be weighted as heavily. This is the situation reflected in Figure 9. Conversely, if high priority organizations have high mission effectiveness levels as compared to low priority organizations, value scores using equal weights will be lower than those using revealed preference weights.

VI. Conclusions and Recommendations

This chapter discusses conclusions based on the results of the analysis and makes recommendations for future research.

Conclusions

The objective of this research was to develop a methodology, to be used by AFMC/XPM resource managers during the RA-IPT process to compare potential manpower allocation alternatives; and in doing so, to provide insight into allocation alternatives that might provide better results than fallback peanut butter spread allocation methodologies. It is the conclusion of this research that the value model developed can be successfully used for this purpose.

In addition, although allocation alternatives to meet the parameters and constraints of a particular resource allocation exercise were not studied, it is possible to make some conclusions about general strategies commonly used by XPM in developing particular allocation alternatives. In general, peanut butter spread allocation alternatives do not generate model scores as high as those of alternatives based on organization mission effectiveness (model scoring functions) and organization importance (model weights). However, it is important to remember that the framework of every resource allocation exercise will differ, and it is necessary to develop allocation alternatives for comparison using a strategy that meets the needs of the particular exercise at hand. Once appropriate alternatives have been generated, value model output scores can be compared to judge which alternative provides best overall command value, in terms of mission effectiveness.

Recommendations

The research presented here has provided a value model methodology for comparing competing manpower allocation alternatives during resource allocation exercises. Model behavior for some commonly used allocation techniques has provided insight into general strategies for developing allocation alternatives.

However, there are certainly some areas in which future research could provide model improvements. The following are some areas where further work is potentially beneficial:

1. Explicit model representation of a larger percentage, or all, of the AFMC command resources.
2. Derivation of scoring functions from actual organization data for a larger percentage, or all, of the command.
3. Analysis of the sensitivity of model outputs to the scoring functions used.
4. Determination of a timeline for updating data from AFMC organizations and rederiving scoring functions.
5. Evaluation of techniques for updating the model when AFMC experiences changes in organizational structure.
6. Generation of alternate weighting schemes and further analysis of model sensitivity to input weights.
7. Incorporation of alternative generation methodologies, including possible generation of an optimal allocation alternative.

8. Enhancement of the model's overall score computation spreadsheet into a user-friendly application that allows easy input of model weights and manpower levels for all alternatives of interest.

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
PM MEB				Scoring	Current
0.136				Function	Manpower
	ASC	EN	0.295	1	1856
	0.311	AQ	0.247	2	1551
		AL	0.108	3	680
		PK	0.101	4	635
		FR	0.075	5	473
		SC	0.074	6	465
		RE	0.018	7	111
		FM	0.017	8	109
		OTHER	0.064	9	404
	ESC	FF	0.290	10	1171
	0.200	TE	0.239	11	964
		EN	0.180	12	727
		FM	0.065	13	264
		PK	0.057	14	229
		IM	0.044	15	178
		AL	0.033	16	134
		SC	0.028	17	114
		OTHER	0.063	18	254
	HSC	YA	0.701	19	277
	0.020	PK	0.089	20	35
		FM	0.063	21	25
		SC	0.025	22	10
		OTHER	0.122	23	48
	SMC	ME	0.098	24	601
	0.304	MG	0.092	25	562
		CW	0.081	26	498
		MC	0.076	27	464
		XR	0.072	28	445
		MT	0.069	29	423
		CZ	0.065	30	400
		CE	0.057	31	351
		CL	0.057	32	349
		CY	0.046	33	284
		CU	0.046	34	283
		FM	0.046	35	283
		PK	0.046	36	281
		CI	0.032	37	194
		SD	0.027	38	167
		AL	0.020	39	123
		OTHER	0.071	40	434
	OTHER	OTHER	1.000	41	3326
	0.165				

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
S&T MEB				Scoring	Current
0.052				Function	Manpower
	WRIGHT	WD	0.216	42	658
	0.394	WB	0.157	43	477
		WF	0.130	44	395
		WE	0.126	45	384
		WR	0.126	46	384
		WC	0.050	47	153
		DJ	0.044	48	133
		PK	0.041	49	125
		WH	0.031	50	94
		OTHER	0.079	51	239
	ROME	LR	0.317	52	348
	0.142	LO	0.186	53	204
		LA	0.139	54	153
		LK	0.136	55	149
		JX	0.086	56	94
		OTHER	0.137	57	151
	ARMSTRONG	HR	0.242	58	253
	0.135	CF	0.231	59	242
		DO	0.151	60	158
		AO	0.138	61	145
		OE	0.133	62	139
		EQ	0.047	63	49
		XP	0.041	64	43
		OTHER	0.017	65	18
	PHILLIPS	DO	0.241	66	516
	0.277	WS	0.122	67	260
		GP	0.108	68	231
		LI	0.097	69	207
		RK	0.090	70	192
		SX	0.084	71	179
		VT	0.080	72	170
		PK	0.061	73	130
		XP	0.051	74	110
		OTHER	0.067	75	143
	OTHER	OTHER	1.000	76	404
	0.052				

Appendix A. AFMC Value Model

[illegible]

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
S&IO MEB				Scoring Function	Current Manpower
0.453					
	OC-ALC	LA	0.667	100	12236
	0.273	LI	0.116	101	2126
		LP	0.110	102	2027
		TI	0.054	103	987
		PK	0.014	104	265
		LG	0.014	105	256
		FM	0.012	106	219
		OTHER	0.013	107	236
	OO-ALC	LA	0.302	108	3614
	0.178	LI	0.273	109	3261
		LM	0.206	110	2469
		TI	0.132	111	1580
		LG	0.031	112	367
		PK	0.022	113	264
		FM	0.014	114	162
		OTHER	0.020	115	242
	SA-ALC	LP	0.316	116	3509
	0.165	LA	0.200	117	2226
		LD	0.176	118	1959
		TI	0.107	119	1191
		LG	0.050	120	553
		PK	0.038	121	425
		NW	0.034	122	382
		LT	0.022	123	248
		FM	0.019	124	211
		SF	0.011	125	127
		OTHER	0.025	126	273
	SM-ALC	LA	0.253	127	1920
	0.113	LH	0.252	128	1909
		LI	0.192	129	1458
		TI	0.189	130	1432
		QL	0.024	131	179
		FM	0.022	132	166
		MA	0.020	133	153
		PK	0.018	134	140
		OTHER	0.031	135	233
	WR-ALC	TI	0.171	136	2170
	0.189	LJ	0.155	137	1964
		LB	0.125	138	1590
		LN	0.125	139	1590
		LY	0.113	140	1433
		LF	0.104	141	1320
		LK	0.089	142	1131
		LG	0.032	143	407
		LV	0.025	144	317
		PK	0.022	145	284
		FM	0.016	146	205
		MA	0.009	147	112
		OTHER	0.014	148	181
	OTHER	OTHER	1.000	149	5599
	0.083				

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
BOS MEB				Scoring	Current
0.265				Function	Manpower
	ASC	CE	0.191	150	762
	0.101	LG	0.124	151	494
		SC	0.102	152	406
		SP	0.075	153	301
		DM	0.058	154	231
		SG	0.053	155	211
		SV	0.042	156	168
		FR	0.038	157	152
		PK	0.026	158	105
		MS	0.023	159	91
		OTHER	0.270	160	1079
	ESC	IS	0.149	161	1363
	0.232	LS	0.062	162	569
		EI	0.045	163	407
		SD	0.041	164	372
		OS	0.035	165	324
		LG	0.035	166	321
		CE	0.025	167	226
		OP	0.020	168	185
		ES	0.017	169	159
		PK	0.015	170	135
		SC	0.014	171	124
		DP	0.013	172	121
		SV	0.013	173	121
		PG	0.011	174	104
		SP	0.011	175	96
		OTHER	0.493	176	4504
	HSC	CE	0.121	177	164
	0.034	AO	0.110	178	149
		OE	0.103	179	139
		LG	0.092	180	125
		DP	0.084	181	113
		SC	0.081	182	110
		SV	0.078	183	106
		SP	0.049	184	66
		OTHER	0.281	185	380

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
BOS MEB				Scoring	Current
(cont)				Function	Manpower
	SMC	CE	0.154	186	468
	0.077	SC	0.148	187	450
		LG	0.136	188	413
		SP	0.123	189	375
		CM	0.067	190	203
		MW	0.047	191	142
		MS	0.044	192	135
		FM	0.043	193	130
		DP	0.036	194	108
		OTHER	0.203	195	616
	OC-ALC	LG	0.178	196	505
	0.072	CE	0.172	197	487
		SC	0.121	198	343
		SP	0.106	199	301
		DP	0.096	200	273
		SV	0.064	201	181
		FM	0.040	202	113
		EM	0.035	203	100
		PK	0.034	204	95
		OS	0.031	205	87
		OTHER	0.123	206	349
	00-ALC	CE	0.301	207	841
	0.071	LG	0.172	208	479
		SC	0.087	209	244
		DP	0.072	210	202
		SP	0.060	211	168
		SV	0.048	212	133
		OS	0.034	213	95
		MA	0.039	214	110
		OTHER	0.187	215	521
	SA-ALC	CE	0.265	216	769
	0.074	LG	0.151	217	437
		DP	0.115	218	334
		SC	0.098	219	283
		SP	0.065	220	189
		SV	0.053	221	153
		FM	0.036	222	104
		OS	0.031	223	89
		OTHER	0.186	224	540

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
BOS MEB (cont)				Scoring Function	Current Manpower
	SM-ALC	CE	0.254	225	627
	0.063	SC	0.181	226	446
		LG	0.099	227	245
		DP	0.086	228	212
		SP	0.064	229	157
		SV	0.056	230	139
		EM	0.044	231	108
		OTHER	0.215	232	531
	WR-ALC	CE	0.211	233	485
	0.058	LG	0.133	234	305
		DP	0.114	235	263
		SC	0.101	236	232
		SP	0.096	237	221
		SV	0.056	238	129
		SG	0.017	239	40
		OTHER	0.272	240	626
	AEDC	CE	0.471	241	588
	0.032	MY	0.105	242	131
		SC	0.078	243	97
		DP	0.070	244	87
		PK	0.066	245	83
		SP	0.053	246	66
		FM	0.046	247	58
		OTHER	0.111	248	139
	AFDTC	LG	0.225	249	752
	0.085	CE	0.221	250	739
		SP	0.077	251	259
		SC	0.073	252	245
		SV	0.063	253	212
		TS	0.059	254	196
		OS	0.057	255	192
		SG	0.040	256	135
		MS	0.022	257	75
		PK	0.019	258	63
		OTHER	0.143	259	480
	AFFTC	CE	0.310	260	861
	0.070	LG	0.149	261	414
		SP	0.146	262	404
		SC	0.075	263	207
		SV	0.062	264	173
		DP	0.059	265	165
		OS	0.018	266	50
		OTHER	0.181	267	502
	OTHER	OTHER	1.000	268	1233
	0.031				

Appendix B: Mission Effectiveness Survey

N O T I O N A L D A T A

CENTER: _____ 2-LTR: _____

Please answer the following questions concerning the relationship between manpower resources and mission effectiveness in your organization.

1. Your authorized manning level is _____ as of end FY951.
2. What manning increase/decrease (circle one) would optimally size your organization to achieve 100% mission effectiveness? _____ authorizations.
(An entry of zero indicates you are at 100% mission effectiveness with current manning.)
3. If organizational performance at the optimal level is considered 100% mission effectiveness, what percentage level would you say you are attaining with your current manning? _____ %.
4. Below what percentage effectiveness level would your organization critically and terminally fail? _____ % effectiveness / _____ total authorizations remaining.

Comments:

N O T I O N A L D A T A

Thank you for taking the time to complete this survey

Appendix C. Mission Effectiveness Survey Results

AEDC:

<u>CE</u>	<u>Manpower</u>	<u>Effectiveness</u>
	59	100
	46	75
	40	65

<u>DO</u>	<u>Manpower</u>	<u>Effectiveness</u>
	1767	100
	1767	100
	1414	80

<u>DP</u>	<u>Manpower</u>	<u>Effectiveness</u>
	97	100
	87	80
	52	60

<u>FM</u>	<u>Manpower</u>	<u>Effectiveness</u>
	89	100
	87	95
	81	90

<u>MY</u>	<u>Manpower</u>	<u>Effectiveness</u>
	131	100
	131	100
	105	80

<u>PK</u>	<u>Manpower</u>	<u>Effectiveness</u>
	138	100
	138	100
	110	80

<u>SC</u>	<u>Manpower</u>	<u>Effectiveness</u>
	241	100
	224	80
	197	80

<u>AAS/SP</u>	<u>Manpower</u>	<u>Effectiveness</u>
	3	100
	2	50
	2	50

AFDTC:

No Data Collected

Appendix C. Mission Effectiveness Survey Results

<u>AFFTC:</u>	<u>CE</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SV</u>	<u>Manpower</u>	<u>Effectiveness</u>
		841	100		110	100
		719	76		105	90
		596	70		5	10
	<u>DO</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>TS</u>	<u>Manpower</u>	<u>Effectiveness</u>
		455	100		1053	100
		455	100		934	87
		0	0		0	0
	<u>DP</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		97	100			
		87	80			
		52	60			
	<u>II</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		160	100			
		145	71			
		88	55			
	<u>LD/LG</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		2700	100			
		2495	92			
		2300	85			
	<u>OS</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		168	100			
		154	85			
		0	0			
	<u>RG</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		224	100			
		224	92			
		168	75			
	<u>SC</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		350	100			
		275	60			
		275	60			
	<u>SP</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		224	100			
		234	100			
		135				

Appendix C. Mission Effectiveness Survey Results

AFMUSEUM: No Data Collected

AFSAC: No Data Collected

<u>AGMC:</u>	<u>ML</u>	<u>Manpower</u>	<u>Effectiveness</u>
		153	100
		128	72
		0	0

AMARC: No Data Collected

<u>ASC:</u>	<u>AL</u>	<u>Manpower</u>	<u>Effectiveness</u>
		757	100
		711	94
		651	86

	<u>AQ</u>	<u>Manpower</u>	<u>Effectiveness</u>
		1784	100
		1784	100
		1338	75

	<u>EN</u>	<u>Manpower</u>	<u>Effectiveness</u>
		2447	100
		2234	93
		1837	80

	<u>PK</u>	<u>Manpower</u>	<u>Effectiveness</u>
		1128	100
		1054	93
		1023	90

	<u>RE</u>	<u>Manpower</u>	<u>Effectiveness</u>
		220	100
		212	95
		0	0

CASC: No Data Collected

ESC: No Data Collected

Appendix C. Mission Effectiveness Survey Results

FOA: No Data Collected

HQAFMC: Not Included in Research

<u>HSC:</u>	<u>MO</u>	<u>Manpower</u>	<u>Effectiveness</u>
		11	100
		10	70
		5	50

ILSC: No Data Collected

<u>OC-ALC:</u>	<u>CE</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>OS</u>	<u>Manpower</u>	<u>Effectiveness</u>
		985	100		90	100
		885	85		87	95
		420	60		84	90
	<u>DP</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>PK</u>	<u>Manpower</u>	<u>Effectiveness</u>
		295	100		515	100
		295	100		365	72
		221	75		315	60
	<u>EM</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SC</u>	<u>Manpower</u>	<u>Effectiveness</u>
		141	100		399	100
		126	90		351	88
		66	75		264	66
	<u>FM</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SP</u>	<u>Manpower</u>	<u>Effectiveness</u>
		382	100		329	100
		332	85		289	90
		267	30		230	80
	<u>LG</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SV</u>	<u>Manpower</u>	<u>Effectiveness</u>
		841	100		180	100
		761	85		160	88
		380	70		140	60
	<u>LI</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>TI</u>	<u>Manpower</u>	<u>Effectiveness</u>
		2760	100		1124	100
		2126	76		988	84
		1435	61		721	75
	<u>LP</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		2760	100			
		2026	75			
		1450	60			

Appendix C. Mission Effectiveness Survey Results

OO-ALC: No Data Collected

<u>SA-ALC:</u>	<u>CE</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>PK</u>	<u>Manpower</u>	<u>Effectiveness</u>
		997	100		582	100
		834	79		488	83
		683	60		310	53
	<u>DP</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SC</u>	<u>Manpower</u>	<u>Effectiveness</u>
		326	100		303	100
		238	62		241	80
		138	60		227	75
	<u>LD</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SF</u>	<u>Manpower</u>	<u>Effectiveness</u>
		2156	100		178	100
		1960	90		153	86
		1470	75		0	0
	<u>LG</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SP</u>	<u>Manpower</u>	<u>Effectiveness</u>
		1210	100		247	100
		1032	83		243	98
		577	55		210	85
	<u>LP</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SV</u>	<u>Manpower</u>	<u>Effectiveness</u>
		3855	100		164	100
		3505	90		128	84
		2103	60		98	55
	<u>LT</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>TI</u>	<u>Manpower</u>	<u>Effectiveness</u>
		574	100		1322	100
		545	95		1191	90
		344	60		860	65
	<u>NW</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		492	100			
		457	93			
		0	0			
	<u>OS</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		92	100			
		90	98			
		78	85			

Appendix C. Mission Effectiveness Survey Results

<u>SM-ALC:</u>	<u>CE</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>MA</u>	<u>Manpower</u>	<u>Effectiveness</u>
		983	100		226	100
		858	85		206	90
		600	70		185	90
	<u>DP</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>PK</u>	<u>Manpower</u>	<u>Effectiveness</u>
		197	100		257	100
		158	80		217	75
		148	75		200	70
	<u>EM</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>QL</u>	<u>Manpower</u>	<u>Effectiveness</u>
		316	100		420	100
		286	90		357	85
		269	85		336	80
	<u>FM</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SC</u>	<u>Manpower</u>	<u>Effectiveness</u>
		286	100		496	100
		228	66		456	85
		59	50		425	75
	<u>LA</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SP</u>	<u>Manpower</u>	<u>Effectiveness</u>
		2033	100		182	100
		1903	60		164	90
		200	50		102	33
	<u>LG</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SV</u>	<u>Manpower</u>	<u>Effectiveness</u>
		371	100		150	100
		323	87		142	90
		291	78		71	50
	<u>LH</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>TI</u>	<u>Manpower</u>	<u>Effectiveness</u>
		2191	100		1744	100
		1880	86		1408	81
		1045	50		986	70
	<u>LI</u>	<u>Manpower</u>	<u>Effectiveness</u>			
		1428	100			
		1428	100			
		900	40			

Appendix C. Mission Effectiveness Survey Results

<u>SMC:</u>	<u>AL</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>ME</u>	<u>Manpower</u>	<u>Effectiveness</u>
		153	100		575	100
		145	95		543	95
		115	75		403	70
	<u>CE</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>MG</u>	<u>Manpower</u>	<u>Effectiveness</u>
		613	100		568	100
		613	100		568	100
		490	80		426	75
	<u>CI</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>MT</u>	<u>Manpower</u>	<u>Effectiveness</u>
		256	100		775	100
		196	75		435	56
		180	70		388	50
	<u>CL</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>MW</u>	<u>Manpower</u>	<u>Effectiveness</u>
		350	100		65	100
		334	95		65	100
		245	70		48	75
	<u>CU</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>PK</u>	<u>Manpower</u>	<u>Effectiveness</u>
		416	100		340	100
		376	85		323	95
		312	75		272	80
	<u>CW</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SC</u>	<u>Manpower</u>	<u>Effectiveness</u>
		626	100		272	100
		543	86		259	95
		489	78		204	75
	<u>CZ</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SD</u>	<u>Manpower</u>	<u>Effectiveness</u>
		441	100		183	100
		404	91		174	95
		375	85		137	75
	<u>DP</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SP</u>	<u>Manpower</u>	<u>Effectiveness</u>
		95	100		159	100
		119	125		159	100
		95	100		127	80
	<u>FM</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>XR</u>	<u>Manpower</u>	<u>Effectiveness</u>
		363	100		487	100
		345	95		464	95
		290	80		390	80

Appendix C. Mission Effectiveness Survey Results

<u>WR-ALC:</u>	<u>Manpower</u>	<u>Effectiveness</u>		<u>Manpower</u>	<u>Effectiveness</u>
	719	100		1480	100
	593	82		1460	95
	593	82		1400	90
<u>DP</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>LV</u>	<u>Manpower</u>	<u>Effectiveness</u>
	240	100		368	100
	224	90		328	89
	190	80		23	25
<u>FM</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>LY</u>	<u>Manpower</u>	<u>Effectiveness</u>
	304	100		1820	100
	284	93		1400	70
	240	75		1300	65
<u>LB</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>MA</u>	<u>Manpower</u>	<u>Effectiveness</u>
	1610	100		115	100
	1603	95		112	98
	1350	85		108	95
<u>LF</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>PK</u>	<u>Manpower</u>	<u>Effectiveness</u>
	1350	100		406	100
	1337	95		396	95
	1250	90		375	90
<u>LG</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SC</u>	<u>Manpower</u>	<u>Effectiveness</u>
	100	100		239	100
	743	100		190	79
	615	83		120	50
<u>LI</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SG</u>	<u>Manpower</u>	<u>Effectiveness</u>
	2106	100		507	100
	1986	92		458	94
	1830	85		458	94
<u>LK</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SP</u>	<u>Manpower</u>	<u>Effectiveness</u>
	1232	100		224	100
	1157	85		224	100
	1125	80		180	80
<u>LN</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>SV</u>	<u>Manpower</u>	<u>Effectiveness</u>
	1735	100		134	100
	1623	65		116	81
	1400	60		87	65
<u>LR</u>	<u>Manpower</u>	<u>Effectiveness</u>	<u>TI</u>	<u>Manpower</u>	<u>Effectiveness</u>
	286	100		2439	100
	228	80		2277	92
	198	70		1480	65

Appendix D. Scoring Function Coefficients and Bounds

<u>Coefficients of Polynomial Scoring Functions</u>										
Scoring				Lower						Upper
Function	MEB	Subcommand	Two-letter	Bound	X ^{4th}	X ^{3rd}	X ^{2nd}	X	Constant	Bound
1	PM	ASC	EN	1526	-1.59E-12	1.15E-08	-3.09E-05	0.0758	3.96	2033
2	PM	ASC	AQ	1163	0	0.00E+00	0	0.0644	0.0644	1551
3	PM	ASC	AL	623	5.17E-09	-1.40E-05	0.0141	-6.184	1057	724
7	PM	ASC	RE	0	-3.82E-07	1.22E-04	-0.0095	0.9301	0	115
8	PM	ASC	FM	92	5.51E-06	-0.00233	0.367	-24.62	658.7	115
10	PM	ESC	FF	961	3.56E-10	-1.63E-06	0.0028	-1.951	547.3	1281
11	PM	ESC	TE	791	7.28E-10	-2.74E-06	0.00381	-2.218	512.8	1054
12	PM	ESC	EN	596	2.17E-09	-6.15E-06	0.00645	-2.828	493.6	795
13	PM	ESC	FM	217	1.60E-07	-0.00016	0.0628	-10.11	637.6	289
14	PM	ESC	PK	188	1.97E-07	-0.00018	0.0582	-7.98	439.7	250
15	PM	ESC	IM	146	7.37E-07	-0.00051	0.1315	-14.25	606.5	195
16	PM	ESC	AL	110	2.64E-06	-0.00138	0.2675	-21.94	701.8	147
17	PM	ESC	SC	94	5.96E-06	-0.00265	0.4375	-30.74	834.6	125
18	PM	ESC	OTHER	208	1.50E-07	-0.00015	0.0543	-8.317	507.1	278
19	PM	HSC	YA	227	1.04E-07	-0.00011	0.0449	-7.495	498.4	303
20	PM	HSC	PK	29	3.09E-04	-0.04213	2.131	-44.26	372.1	38
21	PM	HSC	FM	21	1.56E-03	-0.1526	5.533	-83.58	496.7	27
22	PM	HSC	SC	8	2.50E-02	-0.9708	13.91	-77.84	199	11
23	PM	HSC	OTHER	39	1.53E-04	-0.0286	1.978	-57.9	664.5	53
24	PM	SMC	ME	446	3.75E-09	-8.49E-06	0.00707	-2.411	343.4	636
25	PM	SMC	MG	422	0	0	0	0.1786	-0.357	562
26	PM	SMC	CW	448	-1.62E-08	3.28E-05	-0.02461	8.294	-993.9	574
27	PM	SMC	MC	422	-7.34E-09	1.41E-05	-0.01003	3.295	-357.4	563
28	PM	SMC	XR	374	-2.74E-08	4.72E-05	-0.03023	8.762	-899.8	467
29	PM	SMC	MT	377	-6.63E-11	1.34E-07	-9.24E-05	0.1569	-1.87	754
31	PM	SMC	CE	281	0	0	0	0.2857	-0.286	351
32	PM	SMC	CL	256	-2.68E-08	3.50E-05	-0.01683	3.802	-272.6	366
33	PM	SMC	CY	236	-1.23E-08	1.38E-05	-0.00571	1.329	-63.74	321
35	PM	SMC	FM	238	1.90E-18	-2.22E-16	5.68E-14	0.3333	0.6667	298
36	PM	SMC	PK	237	5.05E-08	-0.00006	0.02235	-3.658	265.8	296
37	PM	SMC	CI	178	-3.65E-07	0.00030	-0.09133	12.39	-575.7	253
38	PM	SMC	SD	131	-3.47E-18	2.67E-15	-4.55E-13	0.5556	2.222	176
39	PM	SMC	AL	98	3.62E-06	-0.00170	0.297	-21.96	644	130
40	PM	SMC	OTHER	361	-7.31E-10	1.25E-06	-0.00080	0.413	-17.02	491
41	PM	OTHER	OTHER	2729	5.35E-12	-6.94E-08	0.00033	-0.6703	534.3	3638
42	S&T	WRIGHT	WD	540	3.66E-09	-9.41E-06	0.00893	-3.566	561.9	720
43	S&T	WRIGHT	WB	391	1.26E-08	-2.34E-05	0.01607	-4.636	530.3	522
44	S&T	WRIGHT	WF	324	2.61E-08	-4.02E-05	0.02289	-5.464	517.7	432
45	S&T	WRIGHT	WE	315	2.95E-08	-4.42E-05	0.02451	-5.691	524	420
46	S&T	WRIGHT	WR	315	2.95E-08	-4.42E-05	0.02451	-5.691	524	420
47	S&T	WRIGHT	WC	126	1.19E-06	-0.00071	0.157	-14.54	532.8	167
48	S&T	WRIGHT	DJ	109	1.21E-06	-0.00062	0.1197	-9.294	300.9	145
50	S&T	WRIGHT	WH	77	9.02E-06	-0.00331	0.4486	-25.6	576.3	103

Appendix D. Scoring Function Coefficients and Bounds

51	S&T	WRIGHT	OTHER	196	1.61E-07	-0.00015	0.0517	-7.386	425.2	261
52	S&T	ROME	LR	285	4.40E-08	-5.97E-05	0.02996	-6.303	526.1	381
53	S&T	ROME	LO	167	3.06E-07	-0.00024	0.07154	-8.728	429.1	223
54	S&T	ROME	LA	126	1.19E-06	-0.00071	0.157	-14.54	532.8	167
55	S&T	ROME	LK	122	1.19E-06	-0.00069	0.1486	-13.32	477.1	163
56	S&T	ROME	JX	77	9.02E-06	-0.0033	0.4486	-25.6	576.3	103
57	S&T	ROME	OTHER	124	1.19E-06	-0.0007	0.1528	-13.92	504.3	165
58	S&T	ARMSTRONG	HR	208	1.94E-07	-0.00019	0.06989	-10.8	652.5	277
59	S&T	ARMSTRONG	CF	199	2.37E-07	-0.00022	0.07824	-11.57	668.7	265
60	S&T	ARMSTRONG	DO	130	1.33E-06	-0.00082	0.1875	-18.12	683.4	173
62	S&T	ARMSTRONG	OE	114	1.66E-06	-0.00090	0.1808	-15.17	506	152
63	S&T	ARMSTRONG	EQ	40	1.53E-04	-0.0292	2.064	-61.95	724.4	54
64	S&T	ARMSTRONG	XP	35	9.77E-05	-0.01634	1.011	-25.1	265.6	47
66	S&T	PHILLIPS	DO	423	8.08E-09	-1.63E-05	0.0121	-3.753	465.5	564
67	S&T	PHILLIPS	WS	213	1.10E-07	-0.00011	0.04189	-6.494	407.4	284
68	S&T	PHILLIPS	GP	190	2.93E-07	-0.00026	0.08809	-12.45	686.4	253
69	S&T	PHILLIPS	LI	170	3.06E-07	-0.00025	0.07375	-9.164	456	226
70	S&T	PHILLIPS	RK	158	5.64E-07	-0.00042	0.1172	-13.72	629.3	210
71	S&T	PHILLIPS	SX	147	7.37E-07	-0.00051	0.133	-14.51	620.9	196
72	S&T	PHILLIPS	VT	139	6.55E-07	-0.00043	0.1063	-10.83	443.5	186
73	S&T	PHILLIPS	PK	109	-2.43E-17	8.88E-16	2.27E-13	0.7143	2.143	137
74	S&T	PHILLIPS	XP	90	2.50E-06	-0.00107	0.1697	-10.87	291.7	120
75	S&T	PHILLIPS	OTHER	117	8.75E-07	-0.00049	0.1004	-8.36	291.8	156
76	S&T	OTHER	OTHER	331	2.31E-08	-3.64E-05	0.02121	-5.168	501.2	442
77	T&E	AEDC	DO	1417	0	0	0	0.0565	-0.057	1771
78	T&E	AEDC	CE	456	-2.94E-09	6.43E-06	-0.00514	1.936	-231.3	672
81	T&E	AFDTC	TS	994	-9.64E-10	4.91E-06	-0.00919	7.588	-2290	1447
82	T&E	AFDTC	LG	601	-7.06E-09	2.18E-05	-0.02465	12.31	-2247	876
83	T&E	AFDTC	TG	448	-2.30E-08	5.27E-05	-0.04445	16.53	-2248	652
85	T&E	AFDTC	OG	308	-1.05E-07	0.00017	-0.09596	24.56	-2298	449
86	T&E	AFDTC	SC	208	-5.29E-07	0.00056	-0.2204	38	-2398	302
88	T&E	AFDTC	OTHER	367	-5.08E-08	9.58E-05	-0.06623	20.2	-2252	535
89	T&E	AFFTC	LG	1992	-1.13E-10	9.73E-07	-0.00315	4.541	-2402	2339
90	T&E	AFFTC	TS	0	-6.44E-12	2.36E-08	-2.00E-05	0.07167	0	1386
91	T&E	AFFTC	DO	0	0	0	0	0.2004	0	499
92	T&E	AFFTC	RG	338	0	0	0	0.2232	-0.446	450
94	T&E	AFFTC	KT	152	-3.42E-07	0.00027	-0.08006	10.82	-529.1	231
95	T&E	AFFTC	SC	104	0	0	0	1.429	-88.57	132
97	T&E	AFFTC	OS	0	-9.42E-07	0.00027	-0.01848	0.9571	0	107
98	T&E	AFFTC	OTHER	957	-2.45E-10	1.24E-06	-0.00228	1.926	-590	1456
99	T&E	OTHER	OTHER	232	-3.10E-07	0.00037	-0.1609	31.01	-2184	338
101	S&IO	OC-ALC	LI	1435	-9.26E-12	7.81E-08	-0.00023	0.3086	-97.95	2760
102	S&IO	OC-ALC	LP	1451	-4.76E-12	3.95E-08	-0.00011	0.1661	-39.21	2761
103	S&IO	OC-ALC	TI	720	-1.73E-09	6.57E-06	-0.00906	5.447	-1134	1123
104	S&IO	OC-ALC	PK	229	3.44E-08	-0.00004	0.01619	-2.528	168.1	374
106	S&IO	OC-ALC	FM	176	2.51E-06	-0.00217	0.6885	-94.11	4684	252
107	S&IO	OC-ALC	OTHER	163	-1.29E-08	1.20E-05	-0.00397	0.8418	-15.78	300
109	S&IO	OO-ALC	LI	2244	-5.26E-12	6.51E-08	-0.00029	0.5806	-379.3	3696

Appendix D. Scoring Function Coefficients and Bounds

110	S&IO	OO-ALC	LM	1699	-1.61E-11	1.51E-07	-0.00051	0.7698	-380.9	2798
111	S&IO	OO-ALC	TI	1087	-9.51E-11	5.70E-07	-0.00123	1.193	-377.4	1791
112	S&IO	OO-ALC	LG	253	-3.27E-08	4.55E-05	-0.0229	5.155	-379.6	416
113	S&IO	OO-ALC	PK	182	-1.26E-07	0.00013	-0.04546	7.353	-390.2	299
114	S&IO	OO-ALC	FM	109	-6.07E-07	0.00037	-0.08244	8.333	-274.6	187
115	S&IO	OO-ALC	OTHER	167	-1.80E-07	0.00016	-0.05469	8.109	-395.1	274
116	S&IO	SA-ALC	LP	2105	-1.85E-12	2.38E-08	-0.00011	0.2307	-130.8	3859
118	S&IO	SA-ALC	LD	1469	-8.60E-11	6.45E-07	-0.00177	2.149	-903.6	2155
119	S&IO	SA-ALC	TI	860	-1.12E-11	5.05E-08	-8.34E-05	0.1352	-15.64	1322
120	S&IO	SA-ALC	LG	309	-2.25E-09	4.58E-06	-0.00324	1.065	-79.41	648
121	S&IO	SA-ALC	PK	270	-1.39E-09	2.25E-06	-0.00129	0.503	-26.07	507
122	S&IO	SA-ALC	NW	0	4.34E-11	-4.85E-08	0.00001	0.2432	0	411
123	S&IO	SA-ALC	LT	157	-1.19E-18	3.33E-16	-7.11E-15	0.3846	-0.385	261
124	S&IO	SA-ALC	FM	142	-2.28E-07	0.00018	-0.05248	6.876	-296.1	243
125	S&IO	SA-ALC	SF	0	4.58E-09	-1.8E-06	0.00015	0.6768	0	148
126	S&IO	SA-ALC	OTHER	166	1.89E-08	-1.90E-05	0.006769	-0.6228	35.23	303
129	S&IO	SM-ALC	LI	919	0	0	0	0.1113	-62.3	1458
130	S&IO	SM-ALC	TI	1003	-8.72E-11	4.90E-07	-0.00098	0.8643	-214.8	1774
131	S&IO	SM-ALC	QL	168	-2.45E-07	0.00018	-0.04986	6.505	-269.8	211
133	S&IO	SM-ALC	MA	137	-1.87E-06	0.00114	-0.2592	26.67	-981.2	168
136	S&IO	WR-ALC	TI	1410	-3.02E-11	2.40E-07	-0.00069	0.8954	-373.7	2324
137	S&IO	WR-ALC	LJ	1810	-1.43E-09	1.12E-05	-0.03263	42.28	-20440	2083
140	S&IO	WR-ALC	LY	1331	-1.92E-10	1.17E-06	-0.00264	2.637	-939.9	1863
143	S&IO	WR-ALC	LG	407	0	0	0	0.2	1.6	492
144	S&IO	WR-ALC	LV	22	-2.49E-09	2.42E-06	-0.00060	0.2443	19.89	356
149	S&IO	OTHER	OTHER	3853	-6.05E-13	1.29E-08	-9.85E-05	0.338	-379.1	6346
158	BOS	ASC	PK	102	-3.09E-15	7.71E-13	-4.28E-11	1	-12	112
186	BOS	SMC	CE	374	0	0	0	0.2128	0.426	468
187	BOS	SMC	SC	354	-7.48E-09	1.28E-05	-0.00814	2.478	-233.4	473
189	BOS	SMC	SP	300	0	0	0	0.2667	0	375
191	BOS	SMC	MW	105	0	0	0	0.6757	4.054	142
193	BOS	SMC	FM	109	-2.43E-17	8.88E-16	2.27E-13	0.7143	2.143	137
194	BOS	SMC	DP	0	0	0	0	1.163	0	86
197	BOS	OC-ALC	CE	231	-8.14E-09	1.39E-05	-0.00817	2.041	-124.3	542
198	BOS	OC-ALC	SC	258	2.05E-09	-2.72E-06	0.00132	-0.0189	20.7	390
199	BOS	OC-ALC	SP	240	-9.08E-08	0.00011	-0.04661	9	-577.7	343
200	BOS	OC-ALC	DP	205	0	0	0	0.3676	-0.368	273
203	BOS	OC-ALC	EM	52	-3.35E-06	0.00120	-0.1489	7.94	-79.45	112
204	BOS	OC-ALC	PK	82	2.00E-06	-0.00082	0.1209	-6.729	161	134
205	BOS	OC-ALC	OS	84	-8.66E-15	5.68E-13	-2.18E-11	1.667	-50	90
206	BOS	OC-ALC	OTHER	228	-2.16E-08	2.83E-05	-0.01328	2.836	-166	397
207	BOS	OO-ALC	CE	638	-9.08E-10	2.98E-06	-0.00356	1.929	-336	970
208	BOS	OO-ALC	LG	363	-8.33E-09	1.56E-05	-0.01059	3.274	-323.4	553
209	BOS	OO-ALC	SC	185	-1.18E-07	0.00011	-0.03892	6.144	-307.9	282
210	BOS	OO-ALC	DP	153	-2.74E-07	0.00022	-0.06192	8.055	-336.5	233
211	BOS	OO-ALC	SP	127	-5.52E-07	0.00036	-0.0862	9.332	-322.4	194
212	BOS	OO-ALC	SV	101	-1.61E-06	0.00083	-0.1576	13.46	-374.5	153
213	BOS	OO-ALC	OS	72	-4.74E-06	0.0018	-0.2375	14.65	-283.5	110

Appendix D. Scoring Function Coefficients and Bounds

214	BOS	00-ALC	MA	83	-3.05E-06	0.00131	-0.2041	14.44	-326.5	127
215	BOS	00-ALC	OTHER	395	-6.15E-09	1.25E-05	-0.00924	3.104	-334.5	601
216	BOS	SA-ALC	CE	630	-1.83E-10	5.65E-07	-0.00064	0.4515	-83.32	919
217	BOS	SA-ALC	LG	244	-5.78E-09	9.30E-06	-0.00520	1.351	-79.53	512
219	BOS	SA-ALC	SC	267	7.64E-08	-0.00009	0.04052	-7.563	559.6	356
221	BOS	SA-ALC	SV	117	1.17E-06	-0.00073	0.1619	-14.64	497.1	196
222	BOS	SA-ALC	FM	70	-3.62E-06	0.00143	-0.2028	13.15	-278.5	120
224	BOS	SA-ALC	OTHER	387	-5.35E-09	1.12E-05	-0.00851	2.863	-297.3	643
227	BOS	SM-ALC	LG	221	8.61E-08	-0.00009	0.0316	-4.764	306.2	281
228	BOS	SM-ALC	DP	199	-6.78E-21	3.02E-16	-6.40E-14	0.3846	-1.538	264
229	BOS	SM-ALC	SP	98	1.19E-06	-0.00069	0.1425	-11.6	338.9	174
230	BOS	SM-ALC	SV	70	-2.10E-06	0.00102	-0.1729	12.74	-293.7	147
232	BOS	SM-ALC	OTHER	424	-3.66E-10	7.62E-07	-0.00058	0.3817	-36.31	600
233	BOS	WR-ALC	CE	485	0	0	0	0.1748	-2.757	588
234	BOS	WR-ALC	LG	305	0	0	0	0.2698	0.698	368
236	BOS	WR-ALC	SC	147	-3.87E-09	3.48E-06	-0.00109	0.4844	-6.862	292
237	BOS	WR-ALC	SP	178	0	0	0	0.4651	-2.791	221
238	BOS	WR-ALC	SV	97	-4.29E-06	0.00216	-0.394	31.73	-891.6	149
239	BOS	WR-ALC	SG	40	0	0	0	1.5	34	44
241	BOS	AEDC	CE	511	-1.96E-09	4.80E-06	-0.00431	1.81	-242.8	754
242	BOS	AEDC	MY	105	0	0	0	0.7692	-0.769	131
244	BOS	AEDC	DP	52	-2.17E-05	0.00690	-0.7811	37.94	-612.9	97
245	BOS	AEDC	PK	66	0	0	0	1.176	2.353	83
246	BOS	AEDC	SP	66	0	0	0	1.515	-50	99
249	BOS	AFDTC	LG	621	-1.03E-08	3.03E-05	-0.03294	15.92	-2838	825
250	BOS	AFDTC	CE	610	-1.09E-08	3.14E-05	-0.03357	15.94	-2793	811
256	BOS	AFDTC	SG	111	-1.04E-05	0.00548	-1.069	92.51	-2952	148
260	BOS	AFFTC	CE	714	-6.55E-09	2.26E-05	-0.02855	15.84	-3190	1007
262	BOS	AFFTC	SP	233	0	0	0	0.2597	-0.520	387
263	BOS	AFFTC	SC	207	0	0	0	0.7143	-87.86	263
264	BOS	AFFTC	SV	8	-2.17E-07	0.00011	-0.01451	0.826	4.265	181
265	BOS	AFFTC	DP	99	-1.69E-06	0.00102	-0.2192	20.23	-621.8	184
266	BOS	AFFTC	OS	0	-1.13E-05	0.00166	-0.05754	1.834	0	55
268	BOS	OTHER	OTHER	960	-2.98E-10	1.43E-06	-0.00253	2.01	-550.1	1402

Appendix D. Scoring Function Coefficients and Bounds

<u>Coefficients of Piecewise Linear Scoring Functions</u>										
Scoring				Lower			Middle			Upper
Function	MEB	Subcommand	Two-letter	Bound	Slope	Intercept	Bound	Slope	Intercept	Bound
4	PM	ASC	PK	616	0.1579	-7.263	635	0.1556	-5.778	680
5	PM	ASC	FR	382	0.3165	-54.7	473	0.1852	7.407	500
6	PM	ASC	SC	376	0.3236	-55.47	465	0.1923	5.577	491
9	PM	ASC	OTHER	326	0.3692	-54.17	404	0.2174	7.174	427
30	PM	SMC	CZ	371	0.2069	8.241	400	0.2432	-6.297	437
34	PM	SMC	CU	235	0.2083	26.04	283	0.5	-56.5	313
49	S&T	WRIGHT	PK	121	0.75	-0.75	125	0.7778	-4.222	134
61	S&T	ARMSTRONG	AO	119	0.7308	-14.96	145	0.6429	-2.214	159
65	S&T	ARMSTRONG	OTHER	15	6.333	-23	18	4.5	10	20
79	T&E	AEDC	SC	112	0.6667	-4.667	127	2	-174	137
80	T&E	AEDC	OTHER	109	0.4	31.4	134	7.5	-920	136
84	T&E	AFDTC	DO	409	0.2177	-36.03	556	0.375	-123.5	596
87	T&E	AFDTC	OS	84	1.067	-36.6	114	1.875	-128.8	122
93	T&E	AFFTC	LD	218	0.3684	4.684	237	0.4211	-7.789	256
96	T&E	AFFTC	IJ	60	0.4103	30.38	99	2.9	-216.1	109
100	S&IO	OC-ALC	LA	10950	0.007776	-35.15	12236	0.04785	-525.5	13072
105	S&IO	OC-ALC	LG	128	0.1172	55	256	0.5556	-57.22	283
108	S&IO	OO-ALC	LA	3234	0.02632	-35.11	3614	0.1619	-525.3	3861
117	S&IO	SA-ALC	LA	1992	0.04274	-35.13	2226	0.2632	-525.8	2378
127	S&IO	SM-ALC	LA	1718	0.0495	-35.05	1920	0.3053	-526.3	2051
128	S&IO	SM-ALC	LH	1061	0.04245	4.958	1909	0.0443	1.424	2225
132	S&IO	SM-ALC	FM	43	0.1301	44.41	166	0.8095	-68.38	208
134	S&IO	SM-ALC	PK	129	0.4545	11.36	140	0.9615	-59.62	166
135	S&IO	SM-ALC	OTHER	119	0.1491	45.25	233	0.6897	-80.69	262
138	S&IO	WR-ALC	LB	1339	0.03984	31.65	1590	0.7143	-1041	1597
139	S&IO	WR-ALC	LN	1372	0.02294	28.53	1590	0.3182	-440.9	1700
141	S&IO	WR-ALC	LF	1234	0.05814	18.26	1320	0.3846	-412.7	1333
142	S&IO	WR-ALC	LK	1100	0.1613	-97.42	1131	0.2055	-147.4	1204
145	S&IO	WR-ALC	PK	269	0.3333	0.3333	284	0.7143	-107.9	291
146	S&IO	WR-ALC	FM	173	0.5625	-22.31	205	0.5	-9.5	219
147	S&IO	WR-ALC	MA	108	0.75	14	112	0.6667	23.33	115
148	S&IO	WR-ALC	OTHER	153	0.4643	3.964	181	0.8	-56.8	196
150	BOS	ASC	CE	666	0.1771	-37.94	762	0.09375	25.56	794
151	BOS	ASC	LG	432	0.2742	-38.45	494	0.1429	26.43	515
152	BOS	ASC	SC	355	0.3333	-38.33	406	0.1765	25.35	423
153	BOS	ASC	SP	263	0.4474	-37.66	301	0.2308	27.54	314
154	BOS	ASC	DM	202	0.5862	-38.41	231	0.3	27.7	241
155	BOS	ASC	SG	185	0.6538	-40.96	211	0.3333	26.67	220
156	BOS	ASC	SV	147	0.8095	-39	168	0.4286	25	175
157	BOS	ASC	FR	133	0.8947	-39	152	0.5	21	158
159	BOS	ASC	MS	80	1.545	-43.64	91	0.75	28.75	95
160	BOS	ASC	OTHER	944	0.1259	-38.87	1079	0.06667	25.07	1124
161	BOS	ESC	IS	1192	0.09942	-38.5	1363	0.05263	25.26	1420
162	BOS	ESC	LS	498	0.2394	-39.24	569	0.125	25.88	593
163	BOS	ESC	EI	356	0.3333	-38.67	407	0.1765	25.18	424

Appendix D. Scoring Function Coefficients and Bounds

164	BOS	ESC	SD	325	0.3617	-37.55	372	0.1875	27.25	388
165	BOS	ESC	OS	283	0.4146	-37.34	324	0.2143	27.57	338
166	BOS	ESC	LG	281	0.425	-39.42	321	0.2143	28.21	335
167	BOS	ESC	CE	198	0.6071	-40.21	226	0.3	29.2	236
168	BOS	ESC	OP	162	0.7391	-39.74	185	0.375	27.63	193
169	BOS	ESC	ES	139	0.85	-38.15	159	0.4286	28.86	166
170	BOS	ESC	PK	118	1	-38	135	0.5	29.5	141
171	BOS	ESC	SC	108	1.063	-34.75	124	0.6	22.6	129
172	BOS	ESC	DP	106	1.133	-40.13	121	0.6	24.4	126
173	BOS	ESC	SV	106	1.133	-40.13	121	0.6	24.4	126
174	BOS	ESC	PG	91	1.308	-39	104	0.75	19	108
175	BOS	ESC	SP	84	1.417	-39	96	0.75	25	100
176	BOS	ESC	OTHER	3939	0.03009	-38.52	4504	0.01579	25.88	4694
177	BOS	HSC	CE	143	0.8095	-35.76	164	0.4286	26.71	171
178	BOS	HSC	AO	130	0.8947	-36.32	149	0.5	22.5	155
179	BOS	HSC	OE	122	1	-42	139	0.5	27.5	145
180	BOS	HSC	LG	109	1.063	-35.81	125	0.6	22	130
181	BOS	HSC	DP	99	1.214	-40.21	113	0.6	29.2	118
182	BOS	HSC	SC	96	1.214	-36.57	110	0.6	31	115
183	BOS	HSC	SV	93	1.308	-41.62	106	0.75	17.5	110
184	BOS	HSC	SP	58	2.125	-43.25	66	1	31	69
185	BOS	HSC	OTHER	332	0.3542	-37.58	380	0.1875	25.75	396
188	BOS	SMC	LG	361	0.3269	-38.02	413	0.1765	24.12	430
190	BOS	SMC	CM	178	0.68	-41.04	203	0.3333	29.33	212
192	BOS	SMC	MS	118	1	-38	135	0.5	29.5	141
195	BOS	SMC	OTHER	539	0.2208	-39	616	0.1154	25.92	642
196	BOS	OC-ALC	LG	252	0.05929	55.06	505	0.283	-57.92	558
201	BOS	OC-ALC	SV	158	1.217	-132.3	181	0.5217	-6.435	204
202	BOS	OC-ALC	FM	91	2.5	-197.5	113	0.8824	-14.71	130
218	BOS	SA-ALC	DP	194	0.01429	57.23	334	0.3089	-41.19	457
220	BOS	SA-ALC	SP	163	0.5	3.5	189	0.6667	-28	192
223	BOS	SA-ALC	OS	77	1.083	1.583	89	1	9	91
225	BOS	SM-ALC	CE	438	0.07937	35.24	627	0.1648	-18.35	718
226	BOS	SM-ALC	SC	416	0.3333	-63.67	446	0.3846	-86.54	485
231	BOS	SM-ALC	EM	102	0.8333	0	108	0.9091	-8.182	119
235	BOS	WR-ALC	DP	223	0.25	24.25	263	0.5263	-48.42	282
240	BOS	WR-ALC	OTHER	580	0.2391	-62.7	626	0.13	5.62	726
243	BOS	AEDC	SC	85	0.8333	-0.8333	97	2.857	-197.1	104
247	BOS	AEDC	FM	54	1.25	22.5	58	5	-195	59
248	BOS	AEDC	OTHER	114	0.44	21.84	139	2.125	-212.4	147
251	BOS	AFDTC	SP	214	0.4889	-43.62	259	0.68	-93.12	284
252	BOS	AFDTC	SC	202	0.5116	-42.35	245	0.7083	-90.54	269
253	BOS	AFDTC	SV	175	0.5946	-43.05	212	0.8095	-88.62	233
254	BOS	AFDTC	TS	162	0.6471	-43.82	196	0.8947	-92.37	215
255	BOS	AFDTC	OS	159	0.6667	-45	192	0.8947	-88.79	211
257	BOS	AFDTC	MS	62	1.692	-43.92	75	2.429	-99.14	82
258	BOS	AFDTC	PK	52	2	-43	63	2.833	-95.5	69
259	BOS	AFDTC	OTHER	396	0.2619	-42.71	480	0.3617	-90.62	527
261	BOS	AFFTC	LG	382	0.2188	1.438	414	0.2353	-5.412	448
267	BOS	AFFTC	OTHER	415	0.3908	-113.2	502	0.3269	-81.12	554

Appendix E. Manpower Levels for Allocation Alternatives

			Lower		Upper	Peanut Butter Spread Alternatives			
MEB	Subcommand	Two-letter	Bound	Current	Bound	Alt1	Alt2	Alt3	Alt4
PM	ASC	EN	1526	1856	2033	1948	1763	1670	1577
PM	ASC	AQ	1163	1551	1551	1628	1473	1395	1318
PM	ASC	AL	623	680	724	714	646	612	578
PM	ASC	PK	616	635	680	666	603	571	539
PM	ASC	FR	382	473	500	496	449	425	402
PM	ASC	SC	376	465	491	488	441	418	395
PM	ASC	RE	0	111	115	116	105	99	94
PM	ASC	FM	92	109	115	114	103	98	92
PM	ASC	OTHER	326	404	427	424	383	363	343
PM	ESC	FF	961	1171	1281	1229	1112	1053	995
PM	ESC	TE	791	964	1054	1012	915	867	819
PM	ESC	EN	596	727	795	763	690	654	617
PM	ESC	FM	217	264	289	277	250	237	224
PM	ESC	PK	188	229	250	240	217	206	194
PM	ESC	IM	146	178	195	186	169	160	151
PM	ESC	AL	110	134	147	140	127	120	113
PM	ESC	SC	94	114	125	119	108	102	96
PM	ESC	OTHER	208	254	278	266	241	228	215
PM	HSC	YA	227	277	303	290	263	249	235
PM	HSC	PK	29	35	38	36	33	31	29
PM	HSC	FM	21	25	27	26	23	22	21
PM	HSC	SC	8	10	11	10	9	9	8
PM	HSC	OTHER	39	48	53	50	45	43	40
PM	SMC	ME	446	601	636	631	570	540	510
PM	SMC	MG	422	562	562	590	533	505	477
PM	SMC	CW	448	498	574	522	473	448	423
PM	SMC	MC	422	464	563	487	440	417	394
PM	SMC	XR	374	445	467	467	422	400	378
PM	SMC	MT	377	423	754	444	401	380	359
PM	SMC	CZ	371	400	437	420	380	360	340
PM	SMC	CE	281	351	351	368	333	315	298
PM	SMC	CL	256	349	366	366	331	314	296
PM	SMC	CY	236	284	321	298	269	255	241
PM	SMC	CU	235	283	313	297	268	254	240
PM	SMC	FM	238	283	298	297	268	254	240
PM	SMC	PK	237	281	296	295	266	252	238
PM	SMC	CI	178	194	253	203	184	174	164
PM	SMC	SD	131	167	176	175	158	150	141
PM	SMC	AL	98	123	130	129	116	110	104
PM	SMC	OTHER	361	434	491	455	412	390	368
PM	OTHER	OTHER	2729	3326	3638	3492	3159	2993	2827
S&T	WRIGHT	WD	540	658	720	690	625	592	559
S&T	WRIGHT	WB	391	477	522	500	453	429	405
S&T	WRIGHT	WF	324	395	432	414	375	355	335
S&T	WRIGHT	WE	315	384	420	403	364	345	326
S&T	WRIGHT	WR	315	384	420	403	364	345	326

Appendix E. Manpower Levels for Allocation Alternatives

S&T	WRIGHT	WC	126	153	167	160	145	137	130
S&T	WRIGHT	DJ	109	133	145	139	126	119	113
S&T	WRIGHT	PK	121	125	134	131	118	112	106
S&T	WRIGHT	WH	77	94	103	98	89	84	79
S&T	WRIGHT	OTHER	196	239	261	250	227	215	203
S&T	ROME	LR	285	348	381	365	330	313	295
S&T	ROME	LO	167	204	223	214	193	183	173
S&T	ROME	LA	126	153	167	160	145	137	130
S&T	ROME	LK	122	149	163	156	141	134	126
S&T	ROME	JX	77	94	103	98	89	84	79
S&T	ROME	OTHER	124	151	165	158	143	135	128
S&T	ARMSTRONG	HR	208	253	277	265	240	227	215
S&T	ARMSTRONG	CF	199	242	265	254	229	217	205
S&T	ARMSTRONG	DO	130	158	173	165	150	142	134
S&T	ARMSTRONG	AO	119	145	159	152	137	130	123
S&T	ARMSTRONG	OE	114	139	152	145	132	125	118
S&T	ARMSTRONG	EQ	40	49	54	51	46	44	41
S&T	ARMSTRONG	XP	35	43	47	45	40	38	36
S&T	ARMSTRONG	OTHER	15	18	20	18	17	16	15
S&T	PHILLIPS	DO	423	516	564	541	490	464	438
S&T	PHILLIPS	WS	213	260	284	273	247	234	221
S&T	PHILLIPS	GP	190	231	253	242	219	207	196
S&T	PHILLIPS	LI	170	207	226	217	196	186	175
S&T	PHILLIPS	RK	158	192	210	201	182	172	163
S&T	PHILLIPS	SX	147	179	196	187	170	161	152
S&T	PHILLIPS	VT	139	170	186	178	161	153	144
S&T	PHILLIPS	PK	109	130	137	136	123	117	110
S&T	PHILLIPS	XP	90	110	120	115	104	99	93
S&T	PHILLIPS	OTHER	117	143	156	150	135	128	121
S&T	OTHER	OTHER	331	404	442	424	383	363	343
T&E	AEDC	DO	1417	1771	1771	1859	1682	1593	1505
T&E	AEDC	CE	456	524	672	550	497	471	445
T&E	AEDC	SC	112	127	137	133	120	114	107
T&E	AEDC	OTHER	109	134	136	140	127	120	113
T&E	AFDTC	TS	994	1350	1447	1417	1282	1215	1147
T&E	AFDTC	LG	601	817	876	857	776	735	694
T&E	AFDTC	TG	448	608	652	638	577	547	516
T&E	AFDTC	DO	409	556	596	583	528	500	472
T&E	AFDTC	OG	308	419	449	439	398	377	356
T&E	AFDTC	SC	208	282	302	296	267	253	239
T&E	AFDTC	OS	84	114	122	119	108	102	96
T&E	AFDTC	OTHER	367	499	535	523	474	449	424
T&E	AFFTC	LG	1992	2161	2339	2269	2052	1944	1836
T&E	AFFTC	TS	0	1229	1386	1290	1167	1106	1044
T&E	AFFTC	DO	0	499	499	523	474	449	424
T&E	AFFTC	RG	338	450	450	472	427	405	382
T&E	AFFTC	LD	218	237	256	248	225	213	201
T&E	AFFTC	KT	152	212	231	222	201	190	180
T&E	AFFTC	SC	104	104	132	109	98	93	88

Appendix E. Manpower Levels for Allocation Alternatives

T&E	AFFTC	IJ	60	99	109	103	94	89	84
T&E	AFFTC	OS	0	98	107	102	93	88	83
T&E	AFFTC	OTHER	957	1338	1456	1404	1271	1204	1137
T&E	OTHER	OTHER	232	315	338	330	299	283	267
S&IO	OC-ALC	LA	10950	12236	13072	12847	11624	11012	10400
S&IO	OC-ALC	LI	1435	2126	2760	2232	2019	1913	1807
S&IO	OC-ALC	LP	1451	2027	2761	2128	1925	1824	1722
S&IO	OC-ALC	TI	720	987	1123	1036	937	888	838
S&IO	OC-ALC	PK	229	265	374	278	251	238	225
S&IO	OC-ALC	LG	128	256	283	268	243	230	217
S&IO	OC-ALC	FM	176	219	252	229	208	197	186
S&IO	OC-ALC	OTHER	163	236	300	247	224	212	200
S&IO	OO-ALC	LA	3234	3614	3861	3794	3433	3252	3071
S&IO	OO-ALC	LI	2244	3261	3696	3424	3097	2934	2771
S&IO	OO-ALC	LM	1699	2469	2798	2592	2345	2222	2098
S&IO	OO-ALC	TI	1087	1580	1791	1659	1501	1422	1343
S&IO	OO-ALC	LG	253	367	416	385	348	330	311
S&IO	OO-ALC	PK	182	264	299	277	250	237	224
S&IO	OO-ALC	FM	109	162	187	170	153	145	137
S&IO	OO-ALC	OTHER	167	242	274	254	229	217	205
S&IO	SA-ALC	LP	2105	3509	3859	3684	3333	3158	2982
S&IO	SA-ALC	LA	1992	2226	2378	2337	2114	2003	1892
S&IO	SA-ALC	LD	1469	1959	2155	2056	1861	1763	1665
S&IO	SA-ALC	TI	860	1191	1322	1250	1131	1071	1012
S&IO	SA-ALC	LG	309	553	648	580	525	497	470
S&IO	SA-ALC	PK	270	425	507	446	403	382	361
S&IO	SA-ALC	NW	0	382	411	401	362	343	324
S&IO	SA-ALC	LT	157	248	261	260	235	223	210
S&IO	SA-ALC	FM	142	211	243	221	200	189	179
S&IO	SA-ALC	SF	0	127	148	133	120	114	107
S&IO	SA-ALC	OTHER	166	273	303	286	259	245	232
S&IO	SM-ALC	LA	1718	1920	2051	2016	1824	1728	1632
S&IO	SM-ALC	LH	1061	1909	2225	2004	1813	1718	1622
S&IO	SM-ALC	LI	919	1458	1458	1530	1385	1312	1239
S&IO	SM-ALC	TI	1003	1432	1774	1503	1360	1288	1217
S&IO	SM-ALC	QL	168	179	211	187	170	161	152
S&IO	SM-ALC	FM	43	166	208	174	157	149	141
S&IO	SM-ALC	MA	137	153	168	160	145	137	130
S&IO	SM-ALC	PK	129	140	166	147	133	126	119
S&IO	SM-ALC	OTHER	119	233	262	244	221	209	198
S&IO	WR-ALC	TI	1410	2170	2324	2278	2061	1953	1844
S&IO	WR-ALC	LJ	1810	1964	2083	2062	1865	1767	1669
S&IO	WR-ALC	LB	1339	1590	1597	1669	1510	1431	1351
S&IO	WR-ALC	LN	1372	1590	1700	1669	1510	1431	1351
S&IO	WR-ALC	LY	1331	1433	1863	1504	1361	1289	1218
S&IO	WR-ALC	LF	1234	1320	1333	1386	1254	1188	1122
S&IO	WR-ALC	LK	1100	1131	1204	1187	1074	1017	961
S&IO	WR-ALC	LG	407	407	492	427	386	366	345
S&IO	WR-ALC	LV	22	317	356	332	301	285	269

Appendix E. Manpower Levels for Allocation Alternatives

S&IO	WR-ALC	PK	269	284	291	298	269	255	241
S&IO	WR-ALC	FM	173	205	219	215	194	184	174
S&IO	WR-ALC	MA	108	112	115	117	106	100	95
S&IO	WR-ALC	OTHER	153	181	196	190	171	162	153
S&IO	OTHER	OTHER	3853	5599	6346	5878	5319	5039	4759
BOS	ASC	CE	666	762	794	800	723	685	647
BOS	ASC	LG	432	494	515	518	469	444	419
BOS	ASC	SC	355	406	423	426	385	365	345
BOS	ASC	SP	263	301	314	316	285	270	255
BOS	ASC	DM	202	231	241	242	219	207	196
BOS	ASC	SG	185	211	220	221	200	189	179
BOS	ASC	SV	147	168	175	176	159	151	142
BOS	ASC	FR	133	152	158	159	144	136	129
BOS	ASC	PK	102	105	112	110	99	94	89
BOS	ASC	MS	80	91	95	95	86	81	77
BOS	ASC	OTHER	944	1079	1124	1132	1025	971	917
BOS	ESC	IS	1192	1363	1420	1431	1294	1226	1158
BOS	ESC	LS	498	569	593	597	540	512	483
BOS	ESC	EI	356	407	424	427	386	366	345
BOS	ESC	SD	325	372	388	390	353	334	316
BOS	ESC	OS	283	324	338	340	307	291	275
BOS	ESC	LG	281	321	335	337	304	288	272
BOS	ESC	CE	198	226	236	237	214	203	192
BOS	ESC	OP	162	185	193	194	175	166	157
BOS	ESC	ES	139	159	166	166	151	143	135
BOS	ESC	PK	118	135	141	141	128	121	114
BOS	ESC	SC	108	124	129	130	117	111	105
BOS	ESC	DP	106	121	126	127	114	108	102
BOS	ESC	SV	106	121	126	127	114	108	102
BOS	ESC	PG	91	104	108	109	98	93	88
BOS	ESC	SP	84	96	100	100	91	86	81
BOS	ESC	OTHER	3939	4504	4694	4729	4278	4053	3828
BOS	HSC	CE	143	164	171	172	155	147	139
BOS	HSC	AO	130	149	155	156	141	134	126
BOS	HSC	OE	122	139	145	145	132	125	118
BOS	HSC	LG	109	125	130	131	118	112	106
BOS	HSC	DP	99	113	118	118	107	101	96
BOS	HSC	SC	96	110	115	115	104	99	93
BOS	HSC	SV	93	106	110	111	100	95	90
BOS	HSC	SP	58	66	69	69	62	59	56
BOS	HSC	OTHER	332	380	396	399	361	342	323
BOS	SMC	CE	374	468	468	491	444	421	397
BOS	SMC	SC	354	450	473	472	427	405	382
BOS	SMC	LG	361	413	430	433	392	371	351
BOS	SMC	SP	300	375	375	393	356	337	318
BOS	SMC	CM	178	203	212	213	192	182	172
BOS	SMC	MW	105	142	142	149	134	127	120
BOS	SMC	MS	118	135	141	141	128	121	114
BOS	SMC	FM	109	130	137	136	123	117	110

Appendix E. Manpower Levels for Allocation Alternatives

BOS	SMC	DP	0	108	86	113	102	97	91
BOS	SMC	OTHER	539	616	642	646	585	554	523
BOS	OC-ALC	LG	252	505	558	530	479	454	429
BOS	OC-ALC	CE	231	487	542	511	462	438	413
BOS	OC-ALC	SC	258	343	390	360	325	308	291
BOS	OC-ALC	SP	240	301	343	316	285	270	255
BOS	OC-ALC	DP	205	273	273	286	259	245	232
BOS	OC-ALC	SV	158	181	204	190	171	162	153
BOS	OC-ALC	FM	91	113	130	118	107	101	96
BOS	OC-ALC	EM	52	100	112	105	95	90	85
BOS	OC-ALC	PK	82	95	134	99	90	85	80
BOS	OC-ALC	OS	84	87	90	91	82	78	73
BOS	OC-ALC	OTHER	228	349	397	366	331	314	296
BOS	00-ALC	CE	638	841	970	883	798	756	714
BOS	00-ALC	LG	363	479	553	502	455	431	407
BOS	00-ALC	SC	185	244	282	256	231	219	207
BOS	00-ALC	DP	153	202	233	212	191	181	171
BOS	00-ALC	SP	127	168	194	176	159	151	142
BOS	00-ALC	SV	101	133	153	139	126	119	113
BOS	00-ALC	OS	72	95	110	99	90	85	80
BOS	00-ALC	MA	83	110	127	115	104	99	93
BOS	00-ALC	OTHER	395	521	601	547	494	468	442
BOS	SA-ALC	CE	630	769	919	807	730	692	653
BOS	SA-ALC	LG	244	437	512	458	415	393	371
BOS	SA-ALC	DP	194	334	457	350	317	300	283
BOS	SA-ALC	SC	267	283	356	297	268	254	240
BOS	SA-ALC	SP	163	189	192	198	179	170	160
BOS	SA-ALC	SV	117	153	196	160	145	137	130
BOS	SA-ALC	FM	70	104	120	109	98	93	88
BOS	SA-ALC	OS	77	89	91	93	84	80	75
BOS	SA-ALC	OTHER	387	540	643	567	513	486	459
BOS	SM-ALC	CE	438	627	718	658	595	564	532
BOS	SM-ALC	SC	416	446	485	468	423	401	379
BOS	SM-ALC	LG	221	245	281	257	232	220	208
BOS	SM-ALC	DP	199	212	264	222	201	190	180
BOS	SM-ALC	SP	98	157	174	164	149	141	133
BOS	SM-ALC	SV	70	139	147	145	132	125	118
BOS	SM-ALC	EM	102	108	119	113	102	97	91
BOS	SM-ALC	OTHER	424	531	600	557	504	477	451
BOS	WR-ALC	CE	485	485	588	509	460	436	412
BOS	WR-ALC	LG	305	305	368	320	289	274	259
BOS	WR-ALC	DP	223	263	282	276	249	236	223
BOS	WR-ALC	SC	147	232	292	243	220	208	197
BOS	WR-ALC	SP	178	221	221	232	209	198	187
BOS	WR-ALC	SV	97	129	149	135	122	116	109
BOS	WR-ALC	SG	40	40	44	42	38	36	34
BOS	WR-ALC	OTHER	580	626	726	657	594	563	532
BOS	AEDC	CE	511	588	754	617	558	529	499
BOS	AEDC	MY	105	131	131	137	124	117	111

Appendix E. Manpower Levels for Allocation Alternatives

BOS	AEDC	SC	85	97	104	101	92	87	82
BOS	AEDC	DP	52	87	97	91	82	78	73
BOS	AEDC	PK	66	83	83	87	78	74	70
BOS	AEDC	SP	66	66	99	69	62	59	56
BOS	AEDC	FM	54	58	59	60	55	52	49
BOS	AEDC	OTHER	114	139	147	145	132	125	118
BOS	AFDTC	LG	621	752	825	789	714	676	639
BOS	AFDTC	CE	610	739	811	775	702	665	628
BOS	AFDTC	SP	214	259	284	271	246	233	220
BOS	AFDTC	SC	202	245	269	257	232	220	208
BOS	AFDTC	SV	175	212	233	222	201	190	180
BOS	AFDTC	TS	162	196	215	205	186	176	166
BOS	AFDTC	OS	159	192	211	201	182	172	163
BOS	AFDTC	SG	111	135	148	141	128	121	114
BOS	AFDTC	MS	62	75	82	78	71	67	63
BOS	AFDTC	PK	52	63	69	66	59	56	53
BOS	AFDTC	OTHER	396	480	527	504	456	432	408
BOS	AFFTC	CE	714	861	1007	904	817	774	731
BOS	AFFTC	LG	382	414	448	434	393	372	351
BOS	AFFTC	SP	233	404	387	424	383	363	343
BOS	AFFTC	SC	207	207	263	217	196	186	175
BOS	AFFTC	SV	8	173	181	181	164	155	147
BOS	AFFTC	DP	99	165	184	173	156	148	140
BOS	AFFTC	OS	0	50	55	52	47	45	42
BOS	AFFTC	OTHER	415	502	554	527	476	451	426
BOS	OTHER	OTHER	960	1233	1402	1294	1171	1109	1048

Bibliography

1. Aered, Captain Jeffery. AFMC/LG, Wright-Patterson AFB OH. Personal interview. 4 December 1994.
2. Bishop, Captain Steven T. A Methodology to Assess the Impact of Manpower Reduction on Air Force Materiel Command. MS thesis, AFIT/GOR/ENS/95M-1. School of Engineering, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, 1985.
3. Clemen, Robert T. Making Hard Decisions: An Introduction to Decision Analysis. Boston: PWS - Kent Publishing Company, 1991.
4. Dent, Major Michael. AFMC/DO, Wright-Patterson AFB OH. Personal interview. 20 October 1994.
5. Dupree, Major Jeff. AFMC/XPM, Wright-Patterson AFB OH. Personal interview. 24 January 1995.
6. James, Frank. AFMC/XPM, Wright-Patterson AFB OH. Personal interview. 24 January 1995.
7. Keeney, Ralph L. and Howard Raiffa. Decisions With Multiple Objectives: Preferences and Value Tradoffs. New York: John Wiley & Sons, 1976.
8. Keeney, Ralph L. Value-Focused Thinking. Cambridge: Harvard University Press, 1992.
9. Mathcad®. Version 4.0, IBM, 1.44MB. disk. Computer software. Mathsoft, Inc., Cambridge MA, 1993
10. Microsoft® Excel. Version 5.0, IBM, 1.44MB, disk. Computer software. Microsoft Corporation, Redmond WA, 1993
11. Paschall, Captain John. AFMC/XR, Wright-Patterson AFB OH. Personal interview. 11 December 1994.
12. Reffle, Captain Mike. AFMC/CE, Wright-Patterson AFB OH. Personal interview. 22 November 1994.

13. Scullion, TSgt Rich. AFMC/XPM, Wright-Patterson AFB OH. Personal interview. 24 January 1995.
14. Svenson, Major Nancy. AFMC/XPM, Wright-Patterson AFB OH. Personal interview. 16 September 1994.

Vita

Sandra K. Smith was born in 1966 in Cincinnati, Ohio. She attended Forest Park High School and graduated as valedictorian in 1984. She graduated from Miami University of Ohio in May, 1988 with a B.A. in Psychology. As an Air Force ROTC distinguished graduate, she received a commission in the USAF and reported for active duty in January 1989 at the Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio. While at ASD, she served as a life-cycle cost (LCC) analyst for the Deputy of Acquisition Logistics, Directorate of Logistics Concepts and Analysis, specializing in the LCC modeling of missile/laser warning systems for transport and fighter aircraft. Her next assignment, in 1991, was to the Armstrong Laboratory, Human Resources Division, Wright-Patterson AFB, Ohio, where she led the Air Force effort to develop Tri-Service specifications for electronic interchange of aircraft technical data for integrated maintenance information systems. She entered the Graduate School of Engineering, Air Force Institute of Technology, in August 1993.

Permanent Address: 101 Annandale Drive
Fairfield, Ohio 45014